HISTORICAL INFORMATION

NORTHERN ELK HERD

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
Yellowstone National Park, Wyoming 83020

IN REPLY REFER TO:

March 11, 1967

The philosophical and scientific basis for the elk management program in Yellowstone National Park is outlined in the documents included in this packet. We urge you to read them carefully. If you have additional questions, you are invited to contact any of the following Park personnel who are directly responsible for formulating and implementing the elk management program.

	Telephone Numbers
Superintendent	344-7385
Chief Park Ranger	344-7497
Chief Park Naturalist	344-7935
Biologist	344-7409

Mailing Address: Box 168 - Yellowstone National Park, Wyoming 83020

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The documents included in this packet are briefly described below.

1. Statement by George B. Hartzog, Jr., Director, National Park Service, Casper, Wyoming - March 11, 1967.

2. Two Photographs and Two Charts.
   Photo No. 1 - A starving elk photographed in Yellowstone National Park in March 1962.

missing 11/98

   Photo No. 2 - A large healthy elk photographed in Yellowstone National Park on March 4, 1967, which shows the result of scientific habitat management.

   Fact Sheet, Yellowstone National Park Elk Management Program. Includes answers to the most frequently asked questions about the elk management program.

3. Management Program, Northern Yellowstone Elk Herd, Yellowstone National Park.
   Outlines the general principles for management of the herd as approved by National Park Service Director George Hartzog on March 1, 1967.

4. Wildlife Management In The National Parks.
   The report of the Secretary of the Interior's Advisory Board on Wildlife Management. Outlines basic philosophy, policy, and procedures for managing wildlife in national parks.

5. Wildlife Management Background Information
   Outlines the history of the northern Yellowstone elk problem, conclusions of scientific studies, methods of herd control, bibliography, table of elk reductions 1934-66, and estimates of the size of the northern Yellowstone elk herd 1892-1966.

6. Distribution Of Live Elk Shipments From Yellowstone National Park.
   Destinations of all elk shipped from the Park since 1892.

7. Long Range Wildlife and Habitat Management Plan For Yellowstone National Park.
   Outlines long term goals and objectives for animal species in the Park that require some kind of management.

8. Cooperative Management Plan For The Northern Yellowstone Elk Herd And Its Habitat.
   Briefly outlines the history of the problem, the policies of the cooperating agencies (National Park Service, U. S. Forest Service, Wyoming Game and Fish Commission, Montana Fish and Game Department), the objective of the management plan, and the program that the agencies have agreed to carry out.

9. Yellowstone National Park Elk Management Program, 1966-67.
   December 6, 1966 press release describing the elk management objectives.

10. Yellowstone's Elk Reduction Program
    The February 3, 1967 press release announcing plans for Park Rangers to begin shooting elk in the Park.

11. Successful Livetrapping Of Elk On Their Winter Range.
    Describes the use of helicopters to trap elk.

12. Conflicts in Recreation - Elk Versus Aspen In Yellowstone National Park.
    Describes (1) the deterioration and decline of aspen the past 40 years due to overbrowsing by elk, (2) the importance of aspen to elk, and (3) how the continuing loss of aspen affects overall Park esthetic, recreational, and scientific values.

STATEMENT OF GEORGE B. HARTZOG, JR.
DIRECTOR, NATIONAL PARK SERVICE, DEPARTMENT OF THE INTERIOR
BEFORE THE
SUBCOMMITTEE OF THE SENATE COMMITTEE ON APPROPRIATIONS, AT CASPER, WYOMING
MARCH 11, 1967

Mr. Chairman, I welcome the opportunity to appear before you today to discuss the elk management program at Yellowstone National Park.

The wildlife management program of any National Park is an important facet of park management. Yet, it is but one facet of park management. This is especially true at Yellowstone National Park where park management is complex and difficult.

A primary goal of park management, including wildlife management, is to maintain the biotic associations within each park as a vignette of primitive America. The implications of this seemingly simple aspiration are stupendous, as pointed out by Secretary Udall's Advisory Board on Wildlife Management in the National Parks. For example, the wolf, the natural predator which tends to keep wildlife in balance, cannot readily be reintroduced into such parks as Yellowstone and Grand Teton surrounded as they are by ranching communities. In the absence of natural predation, management then becomes imperative in keeping populations in balance with their environment.

At the outset, I think it is important to note that management of the northern Yellowstone elk herd is not a new program. Management of the northern Yellowstone elk herd has a long and interesting history. With your permission I should like to summarize it very briefly.

In 1915, the Game Preservation Committee of the Boone and Crockett Club, which had sought the advice of former President Theodore Roosevelt in the problem of Yellowstone elk, had this to say, "The elk of these herds should have . . . scientific management. The Committee believes that in addition to those killed by sportsmen, several thousand should be killed each year. The number killed must be regulated to establish a correct balance between the food supply and the numbers of elk. The killing must be done by officers under proper regulations. By no other means can the problem of these elk be properly solved." (Crusade for Wildlife. Highlights in Conservation Progress. James B. Trefethen. The Stackpole Company, Harrisburg, Pennsylvania, and the Boone and Crockett Club, New York, N.Y. 1961.) The attention of such authorities as the special committee of the Boone and Crockett Club, and of Graves and Nelson, demonstrated with clarity the need for thorough scientific study of the matter. In 1928, W. M. Rush, a biologist of many years service with the U.S. Forest Service, was assigned to Yellowstone for the sole purpose of studying the elk and their range. Rush's findings, after four years of intensive study, were remarkable and startling: he found that the winter range had deteriorated fully 50% since 1914 due simply to overgrazing and drouth; that on more than one-half of the available range, sheet erosion had removed one to two inches of topsoil. Those well known indicators of overgrazing, cheat grass and rabbitbrush, were already spreading over the lower ranges. All brouse species of plants

showed heavy utilization, and even in those years, sagebrush, a less favored food plant, showed heavy utilization. Rush concluded that the population of the Northern Elk Herd, then numbering between 12,000 and 14,000 animals, should not be allowed to increase until the range could be materially improved. He recommended that range studies should be continued and better census methods should be developed as a means of maintaining constant vigilance on range and wildlife trends.

Such studies were continued, and in 1934 the National Park Service became convinced of the need of positive control measures. In that year it was determined to reduce the size of the Northern Elk Herd, and a management plan was formulated incorporating the following management methods:

(1) If hunting outside the Park could not remove the surplus animals, then,

(2) the elk would be livetrapped within the Park for transshipment and restocking purposes. Should these measures prove ineffective, then a third and final step would be taken -- the elk would be killed within the Park.

In 1934, gentlemen, this plan was placed in effect.

For nearly 25 years, from 1911 to 1934, the Problem of elk in the Yellowstone region had received the devoted attention of experts in

the fields of wildlife and range management through a series of studies, surveys, restudies, and reviews. But it is intriguing and important to note that the ultimate decision as to positive action in 1934 produced a plan that had been described almost to the letter in 1915, the plan recommended by Theodore Roosevelt and his Boone and Crockett Club colleagues, which was quoted earlier.

That third step -- direct control, or the killing of elk by park rangers within the park -- is all that was added to the Elk Management Program in 1934. Hunter harvest of elk outside the national park boundaries has been encouraged since the earliest days of Yellowstone. Live shipment of elk from Yellowstone began in 1892, with the sending of a few animals to various zoos throughout the country.

While elk were becoming plentiful in Yellowstone, the species was approaching the brink of extinction elsewhere in North America. Civilization in the form of agriculture, grazing, settlement, market hunting, and tusk collecting, had exterminated the elk from about 90% of its former range. In 1912, Yellowstone National Park began a significant role in restocking those former ranges. A total of 13,827 live elk have been shipped from the Northern Yellowstone Elk Herd to 38 states, Canada and Mexico. Through skillful game management of these "starter herds" by the various state game and fish agencies the popular sport of elk hunting has been perpetuated.

This cooperative venture between the state game agencies and the National Park Service generally has been overlooked in discussions of the Yellowstone elk problem. But I ask you to reflect, gentlemen, what would the status of elk hunting be today if Yellowstone elk had not been reintroduced to former elk ranges? It is safe to say that the majority of elk taken by hunters today are descendents of the northern Yellowstone elk herd!

The National Park Service will continue this important phase of its elk management program. We will endeavor to fill every request for live elk to restock former elk ranges or replenish existing herds. Such restocking programs, of course, must be both biologically and economically sound. To insure this, no live shipment of elk from Yellowstone, except to municipal zoos, will be made which does not have the approval of the state game and fish agencies concerned.

We are encouraged that the demand for live elk has remained high and shows no sign of decreasing in the immediate future. This year, 1,105 elk have been live trapped and shipped out of the park.

Except for live shipments of 33 elk to the Montana Fish and Game Department, and 155 elk to the Wyoming Game and Fish Commission, all of the live elk shipped this year went to other states. The National Park Service concurs that first priorities for live elk should and will be given to requests from Montana and Wyoming.

I have, therefore, instructed Superintendent McLaughlin to contact Commissioner James White of the Wyoming Game and Fish Commission, and Director Frank Dunkle of the Montana Fish and Game Department, to determine their specific needs for live elk by July 1, of each year. These requests will be incorporated into the elk management plan for Yellowstone National Park, will be given top priority in the live-trapping program, and will be made a matter of public record.

Livetrapping elk is difficult, expensive, and certainly is not the panacea of elk management in Yellowstone. We have made significant advancements in livetrapping during the past 5 years, and are going to continue to experiment with trapping techniques in an attempt to improve our effectiveness.

By far, the best locations for trapping elk are where the present five traps are located, and these will probably continue to be the most important areas for trapping. However, two new traps are proposed for construction at higher elevations in the park. We hope these will be effective early and late in the reduction season, and will make it possible to trap animals from those herd segments which do not readily migrate to the lower elevations.

In addition to more traps, I have asked Superintendent McLaughlin to experiment and develop methods for encouraging elk movement into the traps earlier in the fall and winter. Hopefully, a technique of

trapping can be developed which does not depend so heavily on weather conditions. While it is doubtful that we can succeed in trapping elk without deep crusted snows, the potential for doing so has not been tested. Next fall we will begin that test. This will increase the cost of herd reduction considerably, and additional monies will be needed to support this activity.

The National Park Service will continue to cooperate to the fullest extent with the Montana Fish and Game Department in the encouragement of hunter harvest of elk outside the national park boundaries--this year more than 1,100 elk, or better than one-third of the total reduction goal, was effected by licensed Montana elk hunters. I sincerely hope that every year can be this successful or better. Without the fine spirit of cooperation which Montana has demonstrated over the years by extending or opening special elk seasons, the surplus elk problem of the Northern Herd would be many times more difficult to resolve.

Another area of cooperation is in the field of game management research. A number of research projects are underway, notably the elk migration study conducted by the Montana Cooperative Wildlife Research Unit, and the elk biological study of the Montana Fish and Game Department. Between 150 and 200 elk are collected for the latter study each year, which is adding important knowledge to our understanding of elk growth

and development, physiology, disease and parasites, nutrition, and reproduction.

All of the information gained is, of course, useful and essential to Yellowstone in refining its elk management program. It is also useful to the various states in evaluating their own elk management programs. As funds and time permit, we would like to increase our research effort. We are especially interested in the ecology of the northern Yellowstone range, including the interrelations and interdependence of all native plants and animals found there.

The third method of elk control practiced at Yellowstone is direct control by shooting in the park. This method is minimized and used only as necessary to supplement the other two control methods. I emphasize, however, that direct control is an integral part of wildlife management in national parks, and may always be essential just as it is this year.

I point out that direct control is selective and humane. Each elk carcass is field dressed, and delivered within six hours to a packing plant in Livingston, Montana, where the animals are thoroughly inspected by the Indian Health Service, and packaged for distribution by the Bureau of Indian Affairs to local Indian Tribes. The alternatives are complete destruction of the range with subsequent malnutrition and starvation of all associated wildlife species, or demoralization of

a magnificent wild elk population through artificial feeding programs which, incidentally, would expose the animals to a slow death of necrotic stomatitis. Neither of these alternatives is humane or practical. And neither will be put into effect in Yellowstone National Park, or any other national park which has an overpopulation of ungulates.

Secretary Udall, during the Yellowstone elk controversy of 1961-62, appointed an advisory committee to investigate wildlife management in national parks. Under the chairmanship of Dr. A. Starker Leopold this committee explored not only wildlife, but the full spectrum of national park resources management. It occurs to me that some of you may not have had an opportunity to read the committee's report, popularly known as "The Leopold Report" --- and I brought a few copies for distribution. The Leopold Report restates and reaffirms the philosophy, purpose and management objectives of the National Park Service. In brief, our task is to maintain or restore, where necessary, the natural communities of the national parks for the aesthetic recreational, educational and inspirational enjoyment of the American people and for scientific understanding of the natural processes governing those communities.

Wildlife is an integral part of the natural communities and wildlife management is an integral part of the park management. Our objective

in wildlife management is to offset the adverse influences of man on the wildlife environments.

This is a complex task for which we do not have all the answers. The impact of civilization is becoming more acute with each passing year. We need answers now, and we need constantly to reevaluate and refine our management programs to meet new pressures and new conditions. In this regard, we welcome suggestions from all quarters. If there is a better way to manage the elk population of Yellowstone National Park -- we want to know it -- and incorporate it in our management program.

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

Washington, D. C. 20240

IN REPLY REFER TO:

MANAGEMENT PROGRAM
NORTHERN YELLOWSTONE ELK HERD
YELLOWSTONE NATIONAL PARK

Introduction:

Man's activities in the region of Yellowstone National Park have altered its earlier ecology. Disruption of primeval relationships between elk and their winter habitat has been one of the more serious consequences.

Yellowstone National Park provides adequate summer range for elk but in winter deep snows force them down to lower elevations where forage is not available because of inadequate winter range. In earlier times the Northern Yellowstone elk herd moved onto winter ranges outside the Park, extending as much as 60 miles or more along the wide Yellowstone River Valley to the north. Development of these lowlands for agriculture and livestock production, along with heavy hunting forced the elk to winter on previously marginal ranges, mostly in the Park.

Yellowstone National Park was established in 1872 and by the late 1800's, due to protection extended by the Park and the settlement of the Yellowstone Valley the Northern elk herd began to increase on the marginal winter range and by 1914 the herd had increased to an estimated 35,000. Serious deterioration of vegetation and soil occurred. Winter mortality began to occur and in the winter of 1919-20, 14,000 died from starvation.

The continuance of these abnormal conditions resulted in the inauguration of a control program for the herd in 1934-35. This program consisted of three essential elements: (1) hunter kill outside of the Park; (2) livetrapping; and, (3) direct field reduction by National Park Service Rangers in the Park. In the 1934-35 winter, 3,265 elk were removed from the herd by these measures. This program has been continued in varying degrees ever since. In the early 1960's it was recognized that more intensive management was required and that more extensive control was necessary to place the elk herd within numbers that could be supported by their environment.

Accordingly, in 1962 the program was evaluated by an Advisory Board to the Secretary of the Interior. The Board confirmed the need for an

active management program and recommended that the National Park Service keep the herd in harmony with recovery and natural maintenance of its habitat within the Park. So that the public may be fully informed as to this aspect of Park management at Yellowstone the following program is established.

Program:

A. The Northern Yellowstone elk herd will be maintained at a level to assure restoration of the winter range so as to support proper numbers of elk and other animals living on the range.

B. The control program to achieve this objective is as follows: Public hunting outside of the Park is recognized as the most desirable means of controlling elk numbers. Elk migration out of the Park will be facilitated whenever possible.

The normal hunting seasons prescribed by the States begin in September. If this public hunting between September and December 1 has not reduced the herd to levels required by the program then other phases of the program will be initiated during the period of December 1 through February 28 when the elk are most apt to be concentrated on the winter range and the elk carcasses may still be utilized for human consumption.

The additional phases of the program shall be as follows: (1) extended special seasons for public hunting outside the Park as established by the States; (2) livetrapping in the Park for transplanting elsewhere; (3) research specimens for National Park Service and cooperating scientists; and (4) direct reduction by National Park Service personnel. It is recognized that it may be necessary, on occasion, to carry on each phase of this program simultaneously. The National Park Service will adjust the use of these control methods to meet varying weather and other relevant conditions each winter, giving highest priority to the opportunities for public hunting outside the Park and livetrapping in the Park for transplanting elsewhere.

C. Cooperative studies and management plans with States and other Federal agencies are to be continued.

D. The short and long term research on distribution and abundance of wildlife populations, changes in habitat conditions, and trends in forage utilization is to be continued and enlarged to provide the basis for continuing evaluation of the management program and to determine annual wildlife reduction requirements. The existing

ecological study of Yellowstone National Park is to be enlarged to include more data: (1) vegetation and soils on wildlife winter range, (2) elk migration patterns, (3) elk food habits and changes in herd sex and age structure and productivity, and (4) better methods of controlling the elk herd, including biological control.

Approved:

/s/ George B. Hartzog
Director
March 1, 1967

FACT SHEET

YELLOWSTONE NATIONAL PARK ELK MANAGEMENT PROGRAM

For the past several years there has been considerable public interest in Yellowstone National Park's elk management program. Those questions most frequently asked are answered below:

Q. Why is the National Park Service reducing the elk herd?

A. The National Park Service is responsible to the American people for the preservation of Yellowstone for the enjoyment of all the people. To meet this responsibility it is necessary to keep the elk herd in proper balance with its habitat and with other animals that depend on the habitat. The herd is too large for the limited amount of food available during the winter. If we allow the elk to multiply in numbers greater than their habitat can support, vegetation will be overgrazed and destroyed. Both elk and other wildlife that share the same range will starve. If this happens, the more than 2,000,000 people who visit Yellowstone each year will no longer be able to view the greatest wildlife display in America. We will have failed to keep this great heritage intact for the enjoyment of future generations.

Q. How did Yellowstone's elk problem develop?

A. Elk, which once roamed throughout much of the United States, were decimated and displaced by settlement of our Nation. Their habitat was taken over by settlers moving West. Today most elk are found in remote, undeveloped areas. The northern Yellowstone elk herd historically wintered in the Yellowstone River valley north of the Park. When man moved into the valley he brought with him the plow, guns, livestock, railroads, ranches, towns, and highways. As a result of this encroachment, much of the elk herd's traditional winter range is no longer available. This has caused an unnatural buildup of elk inside the Park. The excessive numbers of elk have seriously damaged vegetation and soil. Both the elk and other wildlife have been adversely affected. For example, during the winter of 1919-20, 14,000 elk starved in the Park. After that tragedy a wildlife management program was started to prevent starvation of the elk, to preserve the vegetation and soil, and to protect other species of wildlife. The current program of controlling the elk herd through hunter harvest outside the Park and trapping and shooting inside the Park was begun in 1934. The National Park Service believes that the objectives and accomplishments of the program have been met and will continue to preserve and protect the Park for future generations of Americans.

Q. Why don't you trap the elk instead of shooting them?

A. We have had a live trapping program since 1892. Since then over 10,500 elk have been trapped in the Park and shipped throughout the world.

Q. Have you trapped any animals this year?

A. Yes. Of the 2,565 elk removed so far this winter, 1,105 have been live trapped and shipped outside the Park.

Q. Why don't you spend more time trapping and less time shooting?

A. So far this winter only 194 out of 2,565 elk removed from the herd have been shot by rangers in the Park. We have trapped elk whenever we can. However, trapping success is strongly affected by weather conditions, the severity of the winter, and the behaviour of the elk. When the elk are widely scattered in small groups, they are very difficult to trap. Whenever we locate a number of elk close enough to a trap, we try to trap them.

Q. Why can't you increase your trapping operations to avoid shooting elk in the Park?

A. Shooting elk in the Park is resorted to only when elk are located in inaccessible areas where they cannot be trapped. Traps and the roads necessary to service them cannot be built in many mountain areas. Existing traps are being used to the maximum extent possible. Shooting elk within the Park by Park employees is only done after other measures have failed to meet herd reduction requirements

Q. What happens to the elk that are killed in the Park?

A. They are given to the Bureau of Indian Affairs for distribution to Indian tribes.

Q. Why don't you let hunters shoot the animals?

A. Hunters do take most of the animals. This winter over 1,100 out of 2,565 elk removed from the herd were taken by hunters outside the Park.

Q. Why don't you let the general public hunt in the Park?

A. We believe public hunting would not be in the long term public interest. Public hunting has been prohibited in the Park since 1883. Last year this wise policy enabled more than 2,000,000 visitors to see not only elk but bighorn sheep, buffalo, antelope, moose, mule deer, coyotes, bear, and other wildlife in a largely undisturbed, natural setting existing nowhere else in the Nation.

An important goal of our wildlife management program is to accomplish needed control of animal populations with the least adverse effects on the wildlife populations being controlled, other wildlife in the Park, and other Park values. This can be best accomplished by trained Park rangers.

Q. Wouldn't it be more humane to trap the elk rather than shoot them?

A. No. Trapping, handling, and shipping is a very traumatic experience for elk. Remember, they are wild animals very different from cattle and sheep. Even though elk are trapped and shipped, the end result is the same. The final destiny of transplanted elk is still to be taken by hunters in another locality.

Q. Why don't you feed the elk?

A. Artificial feeding is not in keeping with our objective of maintaining natural conditions in the Park. Our wildlife management goal is to produce and maintain healthy populations of animals free roaming in their natural habitat and living on their natural food. There is sufficient natural food for elk and other wildlife when animal numbers are kept in proper balance with their habitat. Experience in other areas has shown that natural vegetation is still overgrazed despite artificial feeding. Feeding the elk would allow them to increase to a point where they would once again threaten the existence of other wildlife. This situation existed before our wildlife management program began to restore a natural balance. Even with artificial feeding, the elk herd would continue to increase to a size where herd reduction would be absolutely necessary.

Q. Wouldn't it be more humane to leave the elk alone and let nature take its course?

A. For those of us in the National Park Service who have seen the slow, steady starvation of elk, and the devastation of vegetation and soil from overgrazing, the answer must be no.

If you are interested in more detailed information that forms the basis for the wildlife management program in Yellowstone National Park, you are invited to write directly to:

The Superintendent
Box 168
Yellowstone National Park, Wyoming 83020

Prepared in:
Yellowstone National Park - March 7, 1967

March 4, 1963

The Honorable Stewart Udall
Secretary of the Interior
Washington 25, D.C.

Dear Mr. Secretary:

Your Advisory Board on Wildlife Management transmits herewith a report entitled "Wildlife Management in the National Parks."

In formulating the conclusions presented in this report, the Board made a major effort to familiarize itself with actual conditions in the parks and monuments. The full Board visited Yellowstone and Grand Teton National Parks where the elk situation has been acute. Individual Board members inspected a number of other parks which in the judgment of the National Park Service have current wildlife problems. Between us in the last few years we have seen nearly all of the major parks and monuments, including those in Hawaii and Alaska. Our recommendations are based principally upon our own knowledge of the parks and their problems.

Additionally, we have endeavored to understand and to evaluate the full spectrum of opinions and viewpoints on park management. In September at Jackson Hole the Board met with five directors of state game departments. In December in Washington we met with five executive officers of conservation organizations. Many other individuals and groups have offered advice and information. All of this was informative and helpful, but we want to make clear to you that our conclusions were not reached by weighing opinions and counter-opinions. The conclusions represent our own collective thinking.

The report as here presented is conceptual rather than statistical in approach. We read thousands of pages of reports, documents, and statistical tables, but used these data only sparingly to illustrate specific points. Emphasis is placed on the philosophy of park management and the ecologic principles involved. Our suggestions are intended to enhance the esthetic, historical, and scientific values of the parks to the American public, vis a vis the mass recreational values. We sincerely hope that you will find it feasible and appropriate to accept this concept of park values.

Respectfully submitted,

Stanley A. Cain

Clarence M. Cottam

Ira N. Gabrielson

Thomas L. Kimball

A. Starker Leopold,
Chairman

WILDLIFE MANAGEMENT IN THE NATIONAL PARKS

Advisory Board on Wildlife Management,
appointed by Secretary of the Interior Udall

A. S. Leopold (Chairman), S. A. Cain, C. M. Cottam, I. N. Gabrielson, T. L. Kimball

March 4, 1963

Historical

In the Congressional Act of 1916 which created the National Park Service, preservation of native animal life was clearly specified as one of the purposes of the parks. A frequently quoted passage of the Act states "....which purpose is to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations."

In implementing this Act, the newly formed Park Service developed a philosophy of wildlife protection, which in that era was indeed the most obvious and immediate need in wildlife conservation. Thus the parks were established as refuges, the animal populations were protected from hunting and their habitats were protected from wildfire. For a time predators were controlled to protect the "good" animals from the "bad" ones, but this endeavor mercifully ceased in the 1930's. On the whole, there was little major change in the Park Service practice of wildlife management during the first 40 years of its existence.

During the same era, the concept of wildlife management evolved rapidly among other agencies and groups concerned with the production of wildlife for recreational hunting. It is now an accepted truism that maintenance of suitable habitat is the key to sustaining animal populations, and that protection, though it is important, is not of itself a substitute for habitat. Moreover, habitat is not a fixed or stable entity that can be set aside and preserved behind a fence, like a cliff dwelling or a petrified tree. Biotic communities change through natural stages of succession. They can be changed deliberately through manipulation of plant and animal populations. In recent years the National Park Service has broadened its concept of wildlife conservation to provide for purposeful management of plant and animal communities as an essential step in preserving wildlife resources "....unimpaired for the enjoyment of future generations." In a few parks active manipulation of habitat is being tested, as for example in the Everglades where controlled burning is now used experimentally to maintain the open glades and piney woods with their interesting animal and plant life. Excess populations of grazing ungulates are being controlled in a number of parks to preserve the forage plants on which the animals depend. The question already has been posed -- how far should the National Park Service go in utilizing the tools of management to maintain wildlife populations?

The concept of park management

The present report proposes to discuss wildlife management in the national parks in terms of three questions which shift emphasis progressively from the general to the specific:

1) What should be the goals of wildlife management in the national parks?

2) What general policies of management are best adapted to achieve the pre-determined goals?

3) What are some of the methods suitable for on-the-ground implementation of policies?

It is acknowledged that this Advisory Board was requested by the Secretary of the Interior to consider particularly one of the methods of management, namely, the procedure of removing excess ungulates from some of the parks. We feel that this specific question can only be viewed objectively in the light of goals and operational policies, and our report is framed accordingly. In speaking of national parks we refer to the whole system of parks and monuments; national recreation areas are discussed briefly near the end of the report.

As a prelude to presenting our thoughts on the goals, policies, and methods of managing wildlife in the parks of the United States we wish to quote in full a brief report on "Management of National Parks and Equivalent Areas" which was formulated by a committee of the First World Conference on National Parks that convened in Seattle in July, 1962. The committee consisted of 15 members of the Conference, representing eight nations; the chairman was Francois Bourliere of France. In our judgment this report suggests a firm basis for park management. The statement of the committee follows:

"1. Management is defined as any activity directed toward achieving or maintaining a given condition in plant and/or animal populations and/or habitats in accordance with the conservation plan for the area. A prior definition of the purposes and objectives of each park is assumed.

Management may involve active manipulation of the plant and animal communities, or protection from modification or external influences.

2. Few of the world's parks are large enough to be in fact self-regulatory ecological units; rather, most are ecological islands subject to direct or indirect modification by activities and conditions in the surrounding areas. These influences may involve such factors as immigration and/or emigration of animal and plant life, changes in the fire regime, and alterations in the surface or subsurface water.

3. There is no need for active modification to maintain large examples of the relatively stable "climax" communities which under protection perpetuate themselves indefinitely. Examples of such communities include large tracts of undisturbed rain-forest, tropical mountain paramos, and arctic tundra.

4. However, most biotic communities are in a constant state of change due to natural or man-caused processes of ecological succession. In these

"successional" communities it is necessary to manage the habitat to achieve or stabilize it at a desired stage. For example, fire is an essential management tool to maintain East African open savanna or American prairie.

5. Where animal populations get out of balance with their habitat and threaten the continued existence of a desired environment, population control becomes essential. This principle applies, for example, in situations where ungulate populations have exceeded the carrying capacity of their habitat through loss of predators, immigration from surrounding areas, or compression of normal migratory patterns. Specific examples include excess populations of elephants in some African parks and of ungulates in some mountain parks.

6. The need for management, the feasibility of management methods, and evaluation of results must be based upon current and continuing scientific research. Both the research and management itself should be undertaken only by qualified personnel. Research, management planning, and execution must take into account, and if necessary regulate, the human uses for which the park is intended.

7. Management based on scientific research is, therefore, not only desirable but often essential to maintain some biotic communities in accordance with the conservation plan of a national park or equivalent area."

The goal of park management in the United States

Item 1 in the report just quoted specifies that "a prior definition of the purposes and objectives of each park is assumed." In other words, the goal must first be defined.

As a primary goal, we would recommend that the biotic associations within each park be maintained, or where necessary recreated, as nearly as possible in the condition that prevailed when the area was first visited by the white man. A national park should represent a vignette of primitive America.

The implications of this seemingly simple aspiration are stupendous. Many of our national parks--in fact most of them--went through periods of indiscriminate logging, burning, livestock grazing, hunting and predator control. Then they entered the park system and shifted abruptly to a regime of equally unnatural protection from lightning fires, from insect outbreaks, absence of natural controls of ungulates, and in some areas elimination of normal fluctuations in water levels. Exotic vertebrates, insects, plants, and plant diseases have inadvertently been introduced. And of course lastly there is the factor of human use--of roads and trampling and camp grounds and pack stock. The resultant biotic associations in many of our parks are artifacts, pure and simple. They represent a complex ecologic history but they do not necessarily represent primitive America.

Restoring the primitive scene is not done easily nor can it be done completely. Some species are extinct. Given time, an eastern hardwood forest can be regrown to maturity but the chestnut will be missing and so will the roar

of pigeon wings. The colorful drapanid finches are not to be heard again in the lowland forests of Hawaii, nor will the jack-hammer of the ivory-bill ring in southern swamps. The wolf and grizzly bear cannot readily be reintroduced into ranching communities, and the factor of human use of the parks is subject only to regulation, not elimination. Exotic plants, animals, and diseases are here to stay. All these limitations we fully realize. Yet, if the goal cannot be fully achieved it can be approached. A reasonable illusion of primitive America could be recreated, using the utmost in skill, judgment, and ecologic sensitivity. This in our opinion should be the objective of every national park and monument.

To illustrate the goal more specifically, let us cite some cases. A visitor entering Grand Teton National Park from the south drives across Antelope Flats. But there are no antelope. No one seems to be asking the question--why aren't there? If the mountain men who gathered here in rendezvous fed their squaws on antelope, a 20th century tourist at least should be able to see a band of these animals. Finding out what aspect of the range needs rectifying, and doing so, would appear to be a primary function of park management.

When the forty-niners poured over the Sierra Nevada into California, those that kept diaries spoke almost to a man of the wide-spaced columns of mature trees that grew on the lower western slope in gigantic magnificence. The ground was a grass parkland, in springtime carpeted with wildflowers. Deer and bears were abundant. Today much of the west slope is a dog-hair thicket of young pines, white fir, incense cedar, and mature brush--a direct function of overprotection from natural ground fires. Within the four national parks--Lassen, Yosemite, Sequoia, and Kings Canyon--the thickets are even more impenetrable than elsewhere. Not only is this accumulation of fuel dangerous to the giant sequoias and other mature trees but the animal life is meager, wildfowers are sparse, and to some at least the vegetative tangle is depressing, not uplifting. Is it possible that the primitive open forest could be restored, at least on a local scale? And if so, how? We cannot offer an answer. But we are posing a question to which there should be an answer of immense concern to the National Park Service.

The scarcity of bighorn sheep in the Sierra Nevada represents another type f management problem. Though they have been effectively protected for nearly nalf a century, there are fewer than 400 bighorns in the Sierra. Two-thirds of them are found in summer along the crest which lies within the eastern border of Sequoia and Kings Canyon National Parks. Obviously, there is some shortcoming of habitat that precludes further increase in the population. The high country is still recovering slowly from the devastation of early domestic sheep grazing so graphically described by John Muir. But the present limitation may not be in the high summer range at all but rather along the eastern slope of the Sierra where the bighorns winter on lands in the jurisdiction of the Forest Service. These areas are grazed in summer by domestic livestock and large numbers of mule deer, and it is possible that such competitive use is adversely affecting the bighorns. It would seem to us that the National Park Service might well take the lead in studying this problem and in formulating cooperative management plans with other agencies even though the management problem lies outside the park boundary. The goal, after all, is to restore the Sierra bighorn. If restoration is achieved in the Sequoia-Kings Canyon region, there might follow a program of reintroduction and restoration of bighorns in Yosemite and Lassen National Parks, and Lava Beds National Monument, within which areas this magnificent native animal is presently extinct.

We hope that these examples clarify what we mean by the goal of park management.

Policies of park management

The major policy change which we would recommend to the National Park Service is that it recognize the enormous complexity of ecologic communities and the diversity of management procedures required to preserve them. The traditional, simple formula of protection may be exactly what is needed to maintain such climax associations as arctic-alpine heath, the rain forests of Olympic peninsula, or the Joshua trees and saguaros of southwestern deserts. On the other hand, grasslands, savannas, aspen, and other successional shrub and tree associations may call for very different treatment. Reluctance to undertake biotic management can never lead to a realistic presentation of primitive America, much of which supported successional communities that were maintained by fires, floods, hurricanes, and other natural forces.

A second statement of policy that we would reiterate--and this one conforms with present Park Service standards--is that management be limited to native plants and animals. Exotics have intruded into nearly all of the parks but they need not be encouraged, even those that have interest or ecologic values of their own. Restoration of antelope in Jackson Hole, for example, should be done by managing native forage plants, not by planting crested wheat grass or plots of irrigated alfalfa. Gambel quail in a desert wash should be observed in the shade of a mesquite, not a tamarisk. A visitor who climbs a volcano in Hawaii ought to see mamane trees and silver-swords, not goats.

Carrying this point further, observable artificiality in any form must be minimized and obscured in every possible way. Wildlife should not be displayed in fenced enclosures; this is the function of a zoo, not a national park. In the same category is artificial feeding of wildlife. Fed bears become bums, and dangerous. Fed elk deplete natural ranges. Forage relationships in wild animals should be natural. Management may at times call for the use of the tractor, chain-saw, rifle, or flame-thrower but the signs and sounds of such activity should be hidden from visitors insofar as possible. In this regard, perhaps the most dangerous tool of all is the roadgrader. Although the American public demands automotive access to the parks, road systems must be rigidly prescribed as to extent and design. Roadless wilderness areas should be permanently zoned. The goal, we repeat, is to maintain or create the mood of wild America. We are speaking here of restoring wildlife to enhance this mood, but the whole effect can be lost if the parks are overdeveloped for motorized travel. If too many tourists crowd the roadways, then we should ration the tourists rather than expand the roadways.

Additionally in this connection, it seems incongruous that there should exist in the national parks mass recreation facilities such as golf courses, ski lifts, motorboat marinas, and other extraneous developments which completely contradict the management goal. We urge the National Park Service to reverse its policy of permitting these nonconforming uses, and to liquidate them as expeditiously as possible (painful as this will be to concessionaires). Above all other policies, the maintenance of naturalness should prevail.

Another major policy matter concerns the research which must form the basis for all management programs. The agency best fitted to study park management problems is the National Park Service itself. Much help and guidance can be obtained from ecologic research conducted by other agencies, but the objectives of park management are so different from those of state fish and game departments, the Forest Service, etc., as to demand highly skilled studies of a very specialized nature. Management without knowledge would be a dangerous policy indeed. Most of the research now conducted by the National Park Service is oriented largely to interpretive functions rather than to management. We urge the expansion of the research activity in the Service to prepare for future management and restoration programs. As models of the type of investigation that should be greatly accelerated we cite some of the recent studies of elk in Yellowstone and of bighorn sheep in Death Valley. Additionally, however, there are needed equally critical appraisals of ecologic relationships in various plant associations and of many lesser organisms such as azaleas, lupines, chipmunks, towhees, and other non-economic species.

In consonance with the above policy statements, it follows logically that every phase of management itself be under the full jurisdiction of biologically trained personnel of the Park Service. This applies not only to habitat manipulation but to all facets of regulating animal populations. Reducing the numbers of elk in Yellowstone or of goats on Haleakala Crater is part of an overall scheme to preserve or restore a natural biotic scene. The purpose is single-minded. We cannot endorse the view that responsibility for removing excess game animals be shared with state fish and game departments whose primary interest would be to capitalize on the recreational value of the public hunting that could thus be supplied. Such a proposal imputes a multiple use concept of park management which was never intended, which is not legally permitted, nor for which can we find any impelling justification today.

Purely from the standpoint of how best to achieve the goal of park management, as here defined, unilateral administration directed to a single objective is obviously superior to divided responsibility in which secondary goals, such as recreational hunting, are introduced. Additionally, uncontrolled public hunting might well operate in opposition to the goal, by removing roadside animals and frightening the survivors, to the end that public viewing of wildlife would be materially impaired. In one national park, namely Grand Teton, public hunting was specified by Congress as the method to be used in controlling elk. Extended trial suggests this to be an awkward administrative tool at best.

Since this whole matter is of particular current interest it will be elaborated in a subsequent section on methods.

Methods of habitat management

It is obviously impossible to mention in this brief report all the possible techniques that might be used by the National Park Service in manipulating plant and animal populations. We can, however, single out a few examples. In so doing, it should be kept in mind that the total area of any one park, or of the parks

collectively, that may be managed intensively is a very modest part indeed. This is so for two reasons. First, critical areas which may determine animal abundance are often a small fraction of total range. One deer study on the west slope of the Sierra Nevada, for example, showed that important winter range, which could be manipulated to support the deer, constituted less than two per cent of the year-long herd range. Roadside areas that might be managed to display a more varied and natural flora and fauna can be rather narrow strips. Intensive management, in short, need not be extensive to be effective. Secondly, manipulation of vegetation is often exorbitantly expensive. Especially will this be true when the objective is to manage "invisibly" --that is, to conceal the signs of management. Controlled burning is the only method that may have extensive application.

The first step in park management is historical research, to ascertain as accurately as possible what plants and animals and biotic associations existed originally in each locality. Much of this has been done already.

A second step should be ecologic research on plant-animal relationships leading to formulation of a management hypothesis.

Next should come small scale experimentation to test the hypothesis in practice. Experimental plots can be situated out of sight of roads and visitor centers.

Lastly, application of tested management methods can be undertaken on critical areas.

By this process of study and pre-testing, mistakes can be minimized. Likewise, public groups vitally interested in park management can be shown the results of research and testing before general application, thereby eliminating possible misunderstanding and friction.

Some management methods now in use by the National Park Service seem to us potentially dangerous. For example, we wish to raise a serious question about the mass application of insecticides in the control of forest insects. Such application may (or may not) be justified in commercial timber stands, but in a national park the ecologic impact can have unanticipated effects on the biotic community that might defeat the overall management objective. It would seem wise to curtail this activity, at least until research and small scale testing have been conducted.

Of the various methods of manipulating vegetation, the controlled use of fire is the most "natural" and much the cheapest and easiest to apply. Unfortunately, however, forest and chaparral areas that have been completely protected from fire for long periods may require careful advance treatment before even the first experimental blaze is set. Trees and mature brush may have to be cut, piled, and burned before a creeping ground fire can be risked. Once fuel is reduced, periodic burning can be conducted safely and at low expense. On the other hand, some situations may call for a hot burn. On Isle Royale, moose range is created by periodic holocausts that open the forest canopy. Maintenance of the moose population is surely one goal of management on Isle Royale.

Other situations may call for the use of the bulldozer, the disc harrow, or the spring-tooth harrow to initiate desirable changes in plant succession. Buffalo wallows on the American prarie were the propagation sites of a host of native flowers and forbs that fed the antelope and the prairie chicken. In the absence of the great herds, wallows can be simulated.

Artificial reintroduction of rare native plants is often feasible. Overgrazing in years past led to local extermination of many delicate perennials such as some of the orchids. Where these are not reappearing naturally they can be transplanted or cultured in a nursery. A native plant, however small and inconspicuous, is as much a part of the biota as a redwood tree or a forage species for elk.

In essence, we are calling for a set of ecologic skills unknown in this country today. Americans have shown a great capacity for degrading and fragmenting native biotas. So far we have not exercised much imagination or ingenuity in rebuilding damaged biotas. It will not be done by passive protection alone.

Control of animal populations

Good park management requires that ungulate populations be reduced to the level that the range will carry in good health and without impairment to the soil, the vegetation, or to habitats of other animals. This problem is world-wide in scope, and includes non-park as well as park lands. Balance may be achieved in several ways.

(a) Natural predation. - Insofar as possible, control through natural predation should be encouraged. Predators are now protected in the parks of the United States, although unfortunately they were not in the early years and the wolf, grizzly bear, and mountain lion became extinct in many of the national parks. Even today populations of large predators, where they still occur in the parks, are kept below optimal level by programs of predator control applied outside the park boundaries. Although the National Park Service has attempted to negotiate with control agencies of federal and local governments for the maintenance of buffer zones around the parks where predators are not subject to systematic control, these negotiations have been only partially successful. The effort to protect large predators in and around the parks should be greatly intensified. At the same time, it must be recognized that predation alone can seldom be relied upon to control ungulate numbers, particularly the larger species such as bison, moose, elk, and deer; additional artificial controls frequently are called for.

(b) Trapping and transplanting. - Traditionally in the past the National Park Service has attempted to dispose of excess ungulates by trapping and transplanting. Since 1392, for example, Yellowstone National Park alone has supplied 10,473 elk for restocking purposes. Many of the elk ranges in the western United States have been restocked from this source. Thousands of deer and lesser numbers of antelope, bighorns, mountain goats, and bison also have been moved from the parks. This program is fully justified so long as breeding stocks are needed. However, most big game ranges of the United States are essentially filled to

carrying capacity, and the cost of a continuing program of trapping and transplanting cannot be sustained solely on the basis of controlling populations within the parks. Trapping and handling of a big game animal usually costs from $50 to $150 and in some situations much more. Since annual surpluses will be produced indefinitely into the future, it is patently impossible to look upon trapping as a practical plan of disposal.

(c) Shooting excess animals that migrate outside the parks. - Many park herds are migratory and can be controlled by public hunting outside the park boundaries. Especially is this true in mountain parks which usually consist largely of summer game range with relatively little winter range. Effective application of this form of control frequently calls for special regulations, since migration usually occurs after normal hunting dates. Most of the western states have cooperated with the National Park Service in scheduling late hunts for the specific purpose of reducing park game herds, and in fact most excess game produced in the parks is so utilized. This is by far the best and the most widely applied method of controlling park populations of ungulates. The only danger is that migratory habits may be eliminated from a herd by differential removal, which would favor survival of non-migratory individuals. With care to preserve, not eliminate, migratory traditions, this plan of control will continue to be the major form of herd regulation in national parks.

(d) Control by shooting within the parks. - Where other methods of control are inapplicable or impractical, excess park ungulates must be removed by killing. As stated above in the discussion of park policy, it is the unanimous recommendation of this Board that such shooting be conducted by competent personnel, under the sole jurisdiction of the National Park Service, and for the sole purpose of animal removal, not recreational hunting. If the magnitude of a given removal program requires the services of additional shooters beyond regular Park Service personnel, the selection, employment, training, deputization, and supervision of such additional personnel should be entirely the responsibility of the National Park Service. Only in this manner can the primary goal of wildlife management in the parks be realized. A limited number of expert riflemen, properly equipped and working under centralized direction, can selectively cull a herd with a minimum of disturbance to the surviving animals or to the environment. General public hunting by comparison is often non-selective and grossly disturbing.

Moreover, the numbers of game animals that must be removed annually from the parks by shooting is so small in relation to normally hunted populations outside the parks as to constitute a minor contribution to the public bag, even if it were so utilized. All of these points can be illustrated in the example of the north Yellowstone elk population which has been a focal point of argument about possible public hunting in national parks.

(e) The case of Yellowstone. - Elk summer in all parts of Yellowstone Park and migrate out in nearly all directions, where they are subject to hunting on adjoining public and private lands. One herd, the so-called Northern Elk Herd, moves only to the vicinity of the park border where it may winter largely inside or outside the park, depending on the severity of the winter. This herd was estimated to number 35,000 animals in 1914 which was far in excess of the carrying capacity of the range. Following a massive die-off in 1919-20 the herd has steadily decreased. Over a period of 27 years, the National Park Service removed 8,825 animals by shooting and 5,765 by live-trapping; concurrently, hunters took 40,745 elk from this herd outside the park. Yet the range continued to deteriorate.

In the winter of 1961-62 there were approximately 10,000 elk in the herd and carrying capacity of the winter range was estimated at 5,000. So the National Park Service at last undertook a definitive reduction program, killing 4,283 elk by shooting, which along with 850 animals removed in other ways (hunting outside the park, trapping, winter kill) brought the herd down to 5,725 as censused from helicopter. The carcasses of the elk were carefully processed and distributed to Indian communities throughout Montana and Wyoming; so they were well used. The point at issue is whether this same reduction could or should have been accomplished by public hunting.

In autumn during normal hunting season the elk are widely scattered through rough inaccessible mountains in the park. Comparable areas, well stocked with elk, are heavily hunted in adjoining national forests. Applying the kill statistics from the forests to the park, a kill of 200-400 elk might be achieved if most of the available pack stock in the area were used to transport hunters within the park. Autumn hunting could not have accomplished the necessary reduction.

In mid-winter when deep snow and bitter cold forced the elk into lower country along the north border of the park, the National Park Service undertook its reduction program. With snow vehicles, trucks, and helicopters they accomplished the unpleasant job in temperatures that went as low as -40°F. Public hunting was out of the question. Thus, in the case most bitterly argued in the press and in legislative halls, reduction of the herd by recreational hunting would have been a practical impossibility, even if it had been in full conformance with park management objectives.

From now on, the annual removal from this herd may be in the neighborhood of 1,000 to 1,800 head. By January 31, 1963, removals had totalled 1,300 (300 shot outside the park by hunters, 600 trapped and shipped, and 406 killed by park rangers). Continued special hunts in Montana and other forms of removal will yield the desired reduction by spring. The required yearly maintenance kill is not a large operation when one considers that approximately 100,000 head of big game are taken annually by hunters in Wyoming and Montana.

(f) Game control in other parks. - In 1961-62, excluding Yellowstone elk, there were approximately 870 native animals transplanted and 827 killed on 18 national parks and monuments. Additionally, about 2,500 feral goats, pigs and burros were removed from three areas. Animal control in the park system as a whole is still a small operation. It should be emphasized, however, that removal programs have not in the past been adequate to control ungulates in many of the parks. Future removals will have to be larger and in many cases repeated annually. Better management of wildlife habitat will naturally produce larger annual surpluses. But the scope of this phase of park operation will never be such as to constitute a large facet of management. On the whole, reductions will be small in relation to game harvests outside the parks. For example, from 50 to 200 deer a year are removed from a problem area in Sequoia National Park; the deer kill in California is 75,000 and should be much larger. In Rocky Mountain National Park 59 elk were removed in 1961-62 and the trim should perhaps be 100 per year in the future; Colorado kills over 10,000 elk per year on open hunting ranges. In part, this relates to the small area of the national park system, which constitutes only 3.9 per cent of the public domain; hunting ranges under the jurisdiction of the Forest Service and Bureau of Land Management make up approximately 70 per cent.

In summary, control of animal populations in the national parks would appear to us to be an integral part of park management, best handled by the National Park Service itself. In this manner excess ungulates have been controlled in the national parks of Canada since 1943, and the same principle is being applied in the parks of many African countries. Selection of personnel to do the shooting likewise is a function of the Park Service. In most small operations this would logically mean skilled rangers. In larger removal programs, there might be included additional personnel, selected from the general public, hired and deputized by the Service or otherwise engaged, but with a view to accomplishing a task, under strict supervision and solely for the protection of park values. Examples of some potentially large removal programs where expanded crews may be needed are mule deer populations on plateaus fringing Dinosaur National Monument and Zion National Park (west side), and white-tailed deer in Acadia National Park.

Wildlife Management on National Recreation Areas

By precedent and logic, the management of wildlife resources on the national recreation areas can be viewed in a very different light than in the park system proper. National recreation areas are by definition multiple use in character as regards allowable types of recreation. Wildlife management can be incorporated into the operational plans of these areas with public hunting as one objective. Obviously, hunting must be regulated in time and place to minimize conflict with other uses, but it would be a mistake for the National Park Service to be unduly restrictive of legitimate hunting in these areas. Most of the existing national recreation areas are federal holdings surrounding large water impoundments; there is little potentiality for hunting. Three national seashore recreational areas on the East Coast (Hatteras, Cape Cod, and Padre Island) offer limited waterfowl shooting. But some of the new areas being acquired or porposed for acquisition will offer substantial hunting opportunity for a variety of game species. This opportunity should be developed with skill, imagination, and (we would hopefully suggest) with enthusiasm.

On these areas as elsewhere, the key to wildlife abundance is a favorable habitat. The skills and techniques of habitat manipulation applicable to parks are equally applicable on the recreation areas. The regulation of hunting, on such areas as are deemed appropriate to open for such use, should be in accord with prevailing state regulations.

New National Parks

A number of new national parks are under consideration. One of the critical issues in the establishment of new parks will be the manner in which the wildlife resources are to be handled. It is our recommendation that the basic objectives and operating procedures of new parks be identical with those of established parks. It would seem awkward indeed to operate a national park system under two sets of ground rules. On the other hand, portions of several proposed parks are so firmly established as traditional hunting grounds that impending closure of hunting may preclude public acceptance of park status. In such cases it may be necessary to designate core areas as national parks in every

sense of the word, establishing protective buffer zones in the form of national recreation areas where hunting is permitted. Perhaps only through compromises of this sort will the park system be rounded out.

Summary

The goal of managing the national parks and monuments should be to preserve, or where necessary to recreate, the ecologic scene as viewed by the first European visitors. As part of this scene, native species of wild animals should be present in maximum variety and reasonable abundance. Protection alone, which has been the core of Park Service wildlife policy, is not adequate to achieve this goal. Habitat manipulation is helpful and often essential to restore or maintain animal numbers. Likewise, populations of the animals themselves must sometimes be regulated to prevent habitat damage; this is especially true of ungulates.

Active management aimed at restoration of natural communities of plants and animals demands skills and knowledge not now in existence. A greatly expanded research program, oriented to management needs, must be developed within the National Park Service itself. Both research and the application of management methods should be in the hands of skilled park personnel.

Insofar as possible, animal populations should be regulated by predation and other natural means. However, predation cannot be relied upon to control the populations of larger ungulates, which sometimes must be reduced artificially.

Most ungulate populations within the parks migrate seasonally outside the park boundaries where excess numbers can be removed by public hunting. In such circumstances the National Park Service should work closely with state fish and game departments and other interested agencies in conducting the research required for management and in devising cooperative management programs.

Excess game that does not leave a park must be removed. Trapping and transplanting has not proven to be a practical method of control, though it is an appropriate source of breeding stock as needed elsewhere.

Direct removal by killing is the most economical and effective way of regulating ungulates within a park. Game removal by shooting should be conducted under the complete jurisdiction of qualified park personnel and solely for the purpose of reducing animals to preserve park values. Recreational hunting is an inappropriate and non-conforming use of the national parks and monuments.

Most game reduction programs can best be accomplished by regular park employees. But as removal programs increase in size and scope, as well may happen under better wildlife management, the National Park Service may find it advantageous to employ or otherwise engage additional shooters from the general public. No objection to this procedure is foreseen so long as the selection, training, and supervision of shooting crews is under rigid control of the Service and the culling operation is made to conform to primary park goals.

Recreational hunting is a valid and potentially important use of national recreation areas, which are also under jurisdiction of the National Park Service. Full development of hunting opportunities on these areas should be provided by the Service.

Yellowstone National Park
Yellowstone National Park, Wyoming December 4, 1964

WILDLIFE MANAGEMENT BACKGROUND INFORMATION

Introduction

The following paper has been prepared to bring the reader factual and up-to-date information upon which Yellowstone National Park bases its extensive wildlife and range management program.

In 1962 Secretary of Interior Udall appointed an Advisory Board composed of professionally competent and respected men in the field of wildlife management to review the wildlife management policies and practices of the National Park Service. This committee made their report to the Secretary, who in turn formally accepted it at the North American Wildlife Conference in Detroit, Michigan, in March 1963.

This Advisory Board was composed of:
Chairman - Dr. A. Starker Leopold of Berkeley, California, assistant to the Chancellor, University of California at Berkeley; Dr. Ira N. Gabrielson, Vienna, Va., President of the Wildlife Management Institute;
Dr. Clarence Cottam, Sinton, Texas, director of the Welder Wildlife Foundation; Thomas L. Kimball, McLean, Va., executive director of the National Wildlife Federation; and Dr. Stanley A. Cain, Ann Arbor, Michigan, professor and Chairman of the Department of Conservation, University of Michigan.

To arrive at their conclusions they visited many National Park Service areas, especially focusing their field inspections on areas with extensive wildlife management programs. This group spent several days in

Yellowstone National Park reviewing our problems and wildlife management practices. If you have not had the opportunity to read their comprehensive report, a copy will be mailed you upon request to the Superintendent, Yellowstone National Park, Yellowstone National Park, Wyoming. It will furnish you an excellent understanding of National Park Service policy in general and wildlife management policy in particular.

Any review of wildlife and range management must start with the fundamentals of weather, land, plants, and animals.

Fundamentals

Weather is beyond our control as is the production of soil, but soil is our capital. Whatever management plan is adopted its foundation stone must be soil conservation, for once soil cover is lost discussion of herd size or range management is completely futile. Centuries are required for replacement of top soil.

Conservation of plant cover is next in importance. Plants stabilize soil and contribute to its formation. Mistakes in management of plant cover can be rectified in a man's life span if the soil remains unharmed, but it is better to err on the conservative side of plant and soil protection than to risk loss of the soil.

These elements of biology are too often neglected by those whose only interest is hunting elk, yet the elk and other animals constitute the one element of the pyramid whose manipulation can either save or destroy the plants and soil. Here again the conservative view is essential even if unpopular, for if the animal population exceeds the carrying capacity of

ESTIMATED POPULATION
NORTHERN YELLOWSTONE ELK HERD
1892 - 1967

The following estimates of the number of elk in the Northern Yellowstone elk herd for the years shown are the most accurate available. It must be understood that these are estimates, and that over such a long period correspondence, news releases, etc., may have included figures somewhat varied:

Year	Estimated Number		Year	Estimated Number	
1892	25,000		1941	12,500	
1893	25,000		1942	11,700	
1897	15,000		1943*	9,100	
1907	25,000		1944	10,500	
1908	25,000		1945	11,500	
1909	30,000		1946*	10,700	
1910	30,000		1947	9,600	
1912	30,100		1948	12,400	
1913	32,200		1949	11,000	
1914	35,300		1950	12,000	
1916*	29,500		1951	12,000	
1923*	14,500		1952	9,200	
1926	14,000		1953	10,600	
1927*	13,000		1954	11,500	
1928*	14,200		1955	11,800	
1929	13,300		1956*	8,300	
1930	10,600		1957	8,200	
1931	10,600		1958	9,000	
1932	10,600		1959*	7,200	
1933	12,500		1960	7,600	
1934*	13,000		1961*	10,000	(helicopter)
1935*	11,000		1962*	6,800	(helicopter)
1936*	11,000		1963	6,100	
1937*	9,700		1964	6,700	
1938*	11,000		1965*	6,900	(helicopter)
1939	10,800		1966	7,200	
1940	12,000		1967*	5,400	(helicopter)
			1968	5,100	
			1969	6,000	

*Years in which actual count was made; figure printed is estimate based on count.

its range, the plant cover is damaged or lost, erosion produces soil loss, the carrying capacity decreases, and so the spiral down accelerates until something breaks this chain of events. With an unmanaged elk herd that something is usually heavy winter kill due to starvation on a devastated winter range.

Numbers: Too large herds of animals have roamed Yellowstone for more than 40 years and have produced range deterioration and erosion mainly on winter range. Early Superintendents' reports discuss elk and estimates of herd size are revealing: 1897--"I believe that more than 5,000 winter in the Park and that at least 15,000 leave the Park in autumn to winter in the lower country." 1909--"A conservative estimate would place the number of elk in the Park at between 30,000 and 40,000." 1912--"Twenty-seven thousand eight hundred and one animals were counted inside the Park, and 2,300 were observed just outside and, therefore, belonging to the same herd, making a total of 30,101 that actually belonged to the winter herd of the Park." These 1912 figures refer to the northern herd only.

In 1914 the northern herd numbered 35,309 according to a census taken between April 11 and May 2. This figure is the peak recorded. In the winter of 1919-20 the inevitable happened: An estimated 25,000 elk were reduced to 11,000 by winter kill due to lack of food and never again did the northern elk herd reach 20,000.

Appendix A tabulates data concerning the elk control program since its beginning in 1934-35; however, these figures require some explanation. Hunter kill figures are quite accurate through 1955-56 because most of

them are based on checking station counts. Trapping and kills by rangers are based on daily reports of trapping and shooting teams. Winter kill figures are based upon counts of dead elk made by rangers in the field. The lack of figures in this column reflect insignificant winter kills in those years.

Herd counts were not very accurate until the helicopter surveys of 1956, 1961 and 1962. Before then counts were made on foot or horseback and were subject to many errors.

Relationship to Other Species

As mentioned, bison, moose, bighorns, pronghorn and mule deer are other grazing and browsing animals which must compete directly with elk to survive. Bison and moose have no difficulty because of comparable size; however, the smaller species are currently in potential trouble. White-tailed deer are no longer found in the Lamar Valley of the Northern Yellowstone winter range and beaver are very scarce. Assumptions are reasonable that elk competition contributed to their disappearance. Other species, particularly the bighorn, may well go the same route.

The actual objective is healthy range with all animal and plant species together available for public enjoyment now and in all future years.

Scientific Studies

It is probably safe to say that no one herd of any species has received such long and detailed study as the Northern Yellowstone elk herd. From 1911 to the present there has been continuous observation and records. These studies reflect a change from a goal of large numbers of elk for

preservation of the species to gradual realization that the herd was larger than its range could support.

The first outstanding scientific report on Yellowstone's elk problem resulted from the Graves-Nelson study in 1917.[1] Col. Henry S. Graves was Chief Forester of the Forest Service and Dr. E. W. Nelson was Chief of the Bureau of Biological Survey. Even though these gentlemen were interested in building up elk herds instead of reducing them, they were quick to recommend that the elk population in all of the Yellowstone National Park region should remain at their current numbers estimated to be 40,000 to 45,000 elk. Among their other recommendations were two that bear mentioning here: That special studies of elk habits be undertaken, and that close cooperation exist between states and Federal government in elk management.

The recommendation of special studies brought W. M. Rush to Yellowstone in December 1928. From his arrival until April 1932, Mr. Rush studied the elk and their range. Mr. Rush was a long time employee of the Forest Service whose knowledge of biology and the Yellowstone herd made him the best man for the investigations. His findings were included in a 1932 report entitled Northern Yellowstone Elk Study published by the Montana Fish and Game Commission.[2] Several of his conclusions have been fundamental to our present management policies. He found that the winter range had deteriorated fully 50 percent since 1914 due to overgrazing and drouth and that on more than half the range sheet erosion had taken place to a depth of one to two inches. Cheat grass (Bromus tectorum) and rabbitbrush (Chrysothamnus), indicators of overgrazing, were spreading over

the lower range. All browse species were heavily overgrazed by elk and even sagebrush was going fast.

Mr. Rush considered artifical feeding undesirable for several reasons that are equally valid today. He found that elk quickly become dependent on feeding and refused to rustle feed, thus becoming "paupers". Congestion on feeding grounds favored transmission of diseases. Furthermore, artificially fed animals were in poorer condition than ones which rustled all winter.

Rush, like Graves and Nelson before him, was trying to find a way to increase carrying capacity of the range, yet he, too, stated in his recommendations that "no means should be taken to increase the present size of the elk herd until range conditions materially improve. Size of the herd at present between 12,000 to 14,000." He stressed continuing range studies and better census methods as vital to proper conservation of the elk and their range.

Scientific studies were continued by park rangers with range and wildlife management training along the lines indicated by Rush. Study plots and transects were established, winter ranges were mapped at regular intervals, and finally it became clear that some positive control plan had to be adopted to manage the northern herd. And so it was in 1934 that the first real elk control program was devised.

This program called for a reduction of the northern elk herd by 3,000 animals. Principal reliance was placed on trapping within the Park and hunter kill outside the Park during a Montana season extended to permit

hunting when elk were outside the Park. Finally, if these methods failed to bring about the necessary reduction, elk would be killed by park rangers. The objective was achieved with hunters taking 2,598 outside the Park boundary.

For a good summary of the range studies from 1934 to 1938, a report entitled Northern Yellowstone Winter Range Studies, 1938, by District Ranger Rudolf L. Grimm is highly recommended.[3] Having more data on hand than his predecessors, Grimm arrived at a carrying capacity of 7,000 elk for winter range during the average winter month . Grimm recognized that the months of February and March were times when available range was below winter month averages and only about 5,000 elk could be supported. He thought that 6,300 was a good compromise figure for the elk carrying capacity of the northern herd's winter range within Yellowstone National Park. His figures were based on the winter of 1937-38, but similar calculations for three preceding years showed carrying capacities to be of similar magnitude.

Dr. W. B. McDougall, co-author of the definitive book on Yellowstone plants and a recognized authority, made several general observations in 1934 about the winter range.[4] These are simple and readily understandable. He said the only way to bring about any large scale aspen recovery would be to reduce the numbers of browsing animals to a very low minimum. He found abundant evidence of range deterioration but also noted that practically nowhere had deterioration gone so far as to

prohibit reasonably rapid recovery under favorable conditions. Perhaps McDougall's most interesting observation is as follows: "It would be practically an impossibility to determine the carrying capacity of the Yellowstone winter range. There are too many variable factors. The climatic conditions vary greatly from year to year and with these varying climatic conditions not only the amount of forage produced but the total acreage of range utilized varies greatly. Indeed, climate seems to be a much more important factor in the fortunes of the range than numbers of elk, except that the number of elk is a controllable factor and the climate is not. Seemingly the most we can say is that when the range is found to be deteriorating there are too many animals and when it is not deteriorating there are not too many animals."

Such a statement clearly shows the need for studying trends in plant growths and other factors of range productivity. In 1948 a Park Biologist position was established and Walter H. Kittams began a series of studies that are continuing today. These studies are aimed at determining the response of vegetation to easing grazing pressure when the elk control program reduces numbers to 5,000 animals.[5,6]

Summary of Scientific Studies

The most obvious result of the scientific studies to date has been a continuous decrease in the numbers of elk that observers thought the winter range of the northern herd could support: 12,000 to 14,000 in 1932; 6,300 in 1938; 5,000 in 1950. Also, there has been increasing attentinn to other species which share the winter range of the northern elk herd.

The emphasis has shifted from trying to increase winter range by land acquisition and cultivation of suitable land to manipulating the size of the elk herd. From attempts to produce maximum elk herds we have moved towards developing a balanced ecology wherein each species plays an important part.

We know that sometime since the early 1930s some local recovery has been evident in places where the elk control program has been most effective. True, aspen and other browse recovery is less than it should be, and much of the range is still overgrazed, but we know we are moving in the right direction in our management plan for range recovery.

Control Measures

There are five ways man can control the size of the northern elk herd. These are by (1) Public hunting outside the Park; (2) Live trapping elk inside the Park; (3) Direct reduction inside the Park by rangers; (4) Public hunting inside the Park; (5) Biological controls. If man does not exercise these controls, nonselective controls such as disease epidemics and winter kill will come into play and do the job with resultant calamity.

Public Hunting Outside the Park

When elk control began, the best reduction measure was considered to be public hunting along the north boundary of the Park. This has proved true as is borne out by the figures: of a total reduction of 65,620 40,870 elk were killed by hunters.

There are, however, two considerations beyond control of the National Park Service which may decrease the efficiency of this method: first, in mild winters the elk may nor leave the Park in sufficient numbers to permit a large hunter kill; second, since large numbers of elk rarely leave the Park until after the Montana hunting season has closed, the State must reopen the season if a kill is to be made.

There were from 1,000 to 3,000 elk north and outside of the Park between December 15, 1961 and April 1962, and the state season which closed on November 19, 1961 was not reopened to allow hunters to harvest these elk. Such a harvest would have reduced the number that it was necessary for Park rangers to shoot within the Park boundaries, but in the winter of 1962-63, again with an appreciable number of elk north and outside of the Park, the Montana State Fish ans Game Commission reopened the elk season for 9 days from January 25, 1963 to February 3, 1963 and hunters enjoyed the harvest of 505 elk of the Northern Yellowstone elk herd, thus reducing the number necessary to remove from within the Park. Again in February of 1965 hunters were able to harvest 1,012 elk from the Northern Yellowstone elk herd in a reopened 9 day elk season north of the Park.

The northern herd is just one of three major elk herds and several scattered bands in Yellowstone National Park. Most of the elk that summer in the Upper Gallatin Valley, Madison Valley, on the Pitchstone Plateau and the southern part of Yellowstone National Park normally leave the Park when winter weather becomes severe, moving into areas of lower elevation in the adjoining States of Montana, Wyoming and Idaho. Here the surplus wildlife from Yellowstone can be largely harvested by hunters outside of the Park.

Live Trapping

Since 1934 the National Park Service has trapped 8,339 elk, most of which have been planted in surrounding states to establish or supplement resident herds. Through excellent management by state agencies, these herds have grown about as large as they can and have reached full elk carrying capacity of the range they occupy. The Forest Service has established a strict policy regarding the transplanting of elk to nearby national forests, and state agencies are encountering stiffening resistance from stockmen to plant on private lands. Transplants of live animals today are seldom to reestablish depleted herds--they are "put-and-take" affairs. Animal diseases such as brucellosis, anaplasmosis, tularemia, leptospirosis and red water may be factors which can affect future transplants.

Prior to the winter of 1962-63 there was grave doubt that a trapping program would ever take the annual increment to a herd of 5,000 elk which would amount to more than 1,000 each year. Trapping success has been dependent upon scarcity of natural forage and severe winters. Elk wouldn't enter the traps unless they were very hungry. Mild winters of improving range conditions tend to decrease trapping success, which in the best trapping season prior to 1962-63 accounted for only 645 elk. The evidence suggested that live trapping could only supplement other control measures. A major feeding program to facilitate trapping was often suggested but park officials were reluctant to embark on a feedlot operation with its attendant complications, preferring to make every effort to secure better results from open range trapping.

During the winter of 1962-63, using traps carefully located to take advantage of the terrain and natural camouflage and with the aid of two helicopters, about 1,400 elk were live trapped by driving them into the traps.[9] It now appears that Yellowstone National Park may be able to remove a large percentage of the annual increment through live trapping when outlets for live elk in sufficient numbers are available.

Shooting by Rangers

This control method has much to recommend it: It can be increased or decreased at any time; it can be concentrated at specific locations or on sex groups; it avoids the losses of other wildlife. Ranger shooting teams are highly trained men who know how to operate in the Park in the worst weather; they are equipped with specialized equipment for winter work and can utilize Service quarters as operating bases. In short, they are the most efficient control tools and use of helicopters during the 1961-62 winter greatly increased their effectiveness. However, the Service as a matter of policy favors hunting outside the Park over killing inside by ranger teams.

With the new trapping techniques mentioned above, we hope to accomplish most of our necessary annual reductions by live trapping, though localized deteriorating range conditions in inaccessible areas may necessitate the removal of animals from these areas by direct killing methods.

Public Hunting Within the Park

This method is prohibited by law in addition to being contrary to National Park Service policy. There are several good reasons for this: Hunting during the Park visitor season is unthinkable, and after November 1 the weather usually makes hunting hard and dangerous; winter wilderness hunting has a romantic sound but it is not really much fun in bitter zero weather and deep snow; the record of dead moose, bears, coyotes and birds plus elk killed and not utilized resulting from elk hunts elsewhere is indicative of what could happen in Yellowstone should hunting be allowed. The picture is not encouraging.

It is also impossible to say what other uses of Yellowstone National Park might be advocated once elk hunting was permitted. If elk, why not bear, deer, moose, bison, pronghorn, and bighorn? If hunting, why not mining and logging, or dams to raise the elevation of Yellowstone Lake? These hard questions make the National Park Service reluctant to accede to any breakdown of current policy.

But the heart of the matter is simply this: Most people in America do not want hunting in their national parks any more than they want mining or logging, and the parks belong to all America.

Biological Controls

This is an almost unknown field, yet one which is worth watching. If some method could be developed whereby the rate of elk reproduction could be controlled, our problems would be solved. Whether such methods will be developed or when cannot be answered now but must wait on future scientific research.

Summary

We see, then, that control of the prolific Northern Yellowstone elk herd has depended primarily upon hunter kill outside the Park for the bulk of herd reduction, that live trapping and shipping can supplement this kill, and kill by ranger teams can be depended upon to make up any reduction deficit that appears. Only reduction by ranger teams is within control of the Natinnal Park Service. Hunter kills outside the Park depend on weather and the State of Montana; trapping for transplant depends upon continued success of new methods and outlets for live animals. Biological controls are not a sound possibility.

Public Information

There is every evidence that the National Park Service has been openly informative about its plans for elk control. Service representatives have met with State and Federal agencies to discuss mutual problems and have gladly appeared before conservation and sportsmen's groups to present plans.[7] The reports of the Absaroka Conservation Committee contain full details of elk management plans from 1943 to 1954 and frank discussions of them. Press releases have been issued and public meetings held to keep the public informed.

Policy, Management, and Elk

It is National Park Service policy that Yellowstone Natinnal Park present to its visitors a vast wilderness area in as natural a state as possible. This requires that animal populations live in harmony with their environment and each other; that imbalances must be corrected by

natural controls when possible; those created by man must often be corrected by man. The elk control program is designed to reduce an over large herd of elk which has caused deterioration of its winter range. Based on experience and scientific study over 30 years, the program places primary reliance on hunter kill outside the Park with trapping and ranger shooting teams operating inside the Park. The reduction goal - - a maximum northern elk herd of 5,000 until deteriorated range conditions become normal - - has been solidly based on scientific studies. There is absolutely no evidence that the herd is too small; to the contrary, some evidence indicates the herd may still be too large.

The National Park Service must follow valid biological evidence and continue a sound wildlife management program . The Secretary of the Interior's Advisory Board on Wildlife Management, a respected group in this field, submitted guidelines which we are bound to follow in the management of National Park wildlife. These guidelines have generally been accepted as valid by groups interested in our problems and will assist us greatly in a continued sound program.

The National Park Service does not plan to continue to sacrifice its capital, the soil, in a vain effort to save a few hundred elk for a winter or two so they can die of starvation. No responsible authority questions the poor condition of the northern range or the fact that more elk will ruin it. And, if in the final judgment of the years of study

and experience the experts and the administrators should prove utterly wrong, natural reproduction on understocked range will restore any desired herd size in a relatively short period of time.

The many studies of the Northern Yellowstone range and wildlife which have been made over the past 50 years plus the extensive studies being carried on at present will serve as a sound foundation on which to evaluate the success of our management measures and upon which to base future management. Not enough time has passed since our massive herd reduction of 1961-62 to recognize concrete changes in Northern Yellowstone winter range conditions. Numerous recognized and accepted range evaluation studies, both long term and annual, are being carried out by park biologists. The response of the vegetation to the removal of animal grazing pressure will determine whether we have gone far enough in our control measures. Lack of range improvement or continued deterioration of the range will necessitate management decisions relative to further control of animal numbers. In any case the annual increment of elk will have to be removed.

To keep abreast of possible erratic changes in the population dynamics of any of the ungulates using the Northern Yellowstone winter range, herd composition data is being gathered and studies involving all facets of the ecology of this area are being proposed. Funds for such research have been requested so that all avenues of relationship of animals to each other, their range and the soil can be properly fitted into the management program.

The major objective for the Northern Yellowstone wildlife and range remains as it has for fifty years: To have a healthy herd of elk in balance with its range and with all other species which use the same range so that the natural ecological picture can be presented to Park visitors. When beaver can be restored to the Lamar Valley and find ample willow, aspen and cottonwood for their dams and food, and when bighorn populations regain vigor, then some Park officials believe the desirable balance will have been achieved. It will not remain static, it will fluctuate, but Park visitors will have a richer Park experience because of wise management today.

The Secretary of the Interior's Committee on Wildlife Management[10] has stated:

> As a primary goal, we would recommend that the biotic associations within each park be maintained, or where necessary ~~recreated, as nearly as possible in the condition~~ that prevailed when the area was first visited by the white man. A national park should represent a vignette of primitive America.

With the realization that such associations cannot remain static, this is the goal toward which we shall continue to strive.

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RECORD OF ELK REDUCTIONS
Northern Yellowstone Elk Herd
Yellowstone National Park

Period	Hunter kill	Direct Field Reduction	Live trapping	Winter kill	TOTAL REDUCTION	Actual spring count
1934-35	2,598	223	444		3,265	10,647
1935-36	2,287	6*	551	89	2,933	10,112
1936-37	257	394	180	15	846	10,281
1937-38	3,587	11*	225	89	3,912	8,794
1938-39	2,971	--	307	533	3,811	10,976
1939-40	122	--	16	68	206	
1940-41	275	--	12	10	297	
1941-42	2,071	--	145	108	2,324	
1942-43	6,539	691	--	872	8,102	
1943-44	125	--	10	100	235	8,235
1944-45	403	--	--	300	703	
1945-46	2,094	--	73	250	2,417	
1946-47	3,069	--	76	475	3,620	8,513
1947-48	970	--	39	375	1,384	
1948-49	2,837	--	49	300	3,186	7,815
1949-50	40	518	316	184	1,058	
1950-51	1,265	500	312	217	2,294	
1951-52	3,198	52	563	500	4,313	
1952-53	110	7*	165	50	332	
1953-54	422	171	216	241	1,050	
1954-55	763	13*	593	289	1,658	
1955-56	3,900	1,974	645	?	6,519	6,963 (helicopter)
1956-57	345	717	227	?	1,289	
1957-58	50	536	--	?	586	
1958-59	372	1,051	319	?	1,742	4,848 (fixed-wing)
1959-60	50	674	135	?	859	
1960-61	25	1,287	147	?	1,459	8,150 (helicopter)
1961-62	125	4,309	310[1/]	476	5,220	5,725 (helicopter)
1962-63	530	619[2/]	671	negligible	1,820	
1963-64	30	215[5/]	906[3/]	Do.	1,151	
1964-65	1,012	205[5/]	687[4/]	Do.	1,904	4,865 (helicopter)
1965-66	30	181[5/]	1,059[6/]	Do.	1,270	
TOTALS	42,472	14,354	9,398	5,541	71,765	

* Taken for museum specimens or biological studies.
1/ Includes 13 trap loss.
2/ Includes 215 for biological studies.
3/ Includes trap loss of 40.
4/ Includes trap loss of 22.
5/ Biological studies only.
6/ Includes trap loss of 35.

NORTHERN YELLOWSTONE ELK HERD
Estimated Population, 1892 - 1965

The following estimates of the number of elk in the Northern Yellowstone elk herd for the years shown are the most accurate available. It must be understood that these are estimates, and that over such a long period correspondence, news releases, etc., may have included figures somewhat varied:

Year	Estimated number
1892	25,000
1893	25,000
1897	15,000
1907	25,000
1908	25,000
1909	30,000
1910	30,000
1912	30,100
1913	32,200
1914	35,300
1916*	29,500
1923*	14,500
1926	14,000
1927*	13,000
1928*	14,200
1929	13,300
1930	10,600
1931	10,600
1932	10,600
1933	12,500
1934*	13,000
1935*	11,000
1936*	11,000
1937*	9,700
1938*	11,000
1939	10,800
1940	12,000
1941	12,500
1942	11,700
1943*	9,100
1944	10,500
1945	11,500
1946*	10,700
1947	9,600
1948	12,400
1949	11,000
1950	12,000
1951	12,000
1952	9,200
1953	10,600
1954	11,500
1955	11,800
1956*	8,300
1957	8,200
1958	9,000
1959*	7,200
1960	7,600
1961*	10,000 (helicopter)
1962*	6,800 (helicopter)
1963	6,100
1964	6,700
1965*	6,900 (helicopter)

*Years in which actual count was made; figure printed is estimate based on count.

DISTRIBUTION OF LIVE ELK SHIPMENTS
from
YELLOWSTONE NATIONAL PARK

Year	Shipped No.	State or Country:		Receiving Agency:	
1892	4	Washington, D. C.		National Zoological Park	
1893	4	Washington, D. C.		National Zoological Park	
1896	5	Washington, D. C.		National Zoological Park	
1899	9	Washington, D. C.		National Zoological Park	
1900	5	Nebraska		Omaha City Park	
1901	5	Washington, D. C.		National Zoological Park	
1907	2	British Columbia		Vancouver City Park	
1912	220*	Montana	31	Glacier National Park	
		South Dakota	3	Aberdeen	
		Washington	186	Skagit County	46
				Snohomish County	60
				Kings County	80
1913	455	Arizona	80	State of	
		California	50	Shasta County	
		Colorado	25	Estes Park	
		Massachusetts	4	City of Boston	
		Pennsylvania	50	State of	
		Utah	25	State of	
		Virginia	50	State of	25
				Bath County	25
		Washington	121	Yakima County	50
				City of Spokane	6
				Walla Walla	25
				Garfield County	40
		West Virginia	25	State of	
		Wyoming	25	State of (Sundance area)	
1914	99	Colorado	31	Genesee Park	
		Montana	30	State of (Anaconda area)	
		North Dakota	2	Valley City	
		Ohio	3	City of Toledo	
		Oregon	6	Portland	
		South Dakota	2	Hot Springs	
		Washington	25	Stevens County	

* In addition, five carloads of elk were captured at Gardiner by the State of Montana and shipped to various points in Montana for range stocking; 21 to a car or a total of 105.

1915	375	Colorado	50	State of	
		Idaho	50	State of	
		Michigan	25	State of	
		Minnesota	32	State of	30
				Little Falls	2
		Missouri	3	St. Joseph	
		Montana	50	State of	
		New Mexico	50	State of	
		New York	8	Borough of Queens	4
				NYC Zoo	4
		South Carolina	2	Columbia	
		South Dakota	50	State of	
		Utah	25	State of	
		Wisconsin	30	State of	
1916	591*	Alabama	50	State of	
		Colorado	100	Colorado Springs	50
				Pueblo	25
				Idaho Springs	25
		Georgia	2	Atlanta	
		Idaho	50	State of	
		Louisiana	40	State of	
		Montana	71	State of	46
				Moiese	25
		North Dakota	3	Minot City	
		New York	50	State of	
		Pennsylvania	100	State of	
		South Dakota	25	Wind Cave NP	
		Utah	50	State of	
		Washington	50	Kittelas County	
1917	505	California	2	City of San Francisco	
		Canada	63	Jasper Park, Banff	
		Colorado	50	Rollinsville	
		Idaho	50	State of	
		Missouri	50	State of	
		Montana	6	Billings	
		North Carolina	40	State of	
		South Dakota	50	State of	
		Virginia	150	State of	
		Washington,D.C.	4	National Zoological Park	
		Wisconsin	40	State of	

*In addition, 90 elk were captured at Gardiner by State of Montana and shipped to other parts of that state for range stocking.

1918	145	Arizona	60	State of
		Idaho	50	State of
		Illinois	2	City of Aurora
		Minnesota	2	City of Crookston
		Missouri	5	City of Mexico
		Montana	25	State of
		Texas	1	City of Fort Worth
1919	180	Missouri	12	St. Louis City Park
		New York	65	Palisades State Park
		Oklahoma	3	Platt National Park
		South Dakota	100	State of
1920	369	Canada	298	Rocky Mountain Park-Banff 200
				Jasper Park 98
		Illinois	4	City of Aurora
		Minnesota	2	City of Minneapolis
		New Mexico	50	State of
		Pennsylvania	3	City of Allenstown
		Texas	12	A&M College 3
				Sonora Expt. Sta. 7
				San Antonio 2
1921	15	Mississippi	4	City of Jackson
		New York	5	Bronx Zoo
		Oklahoma	2	Platt NP, Sulphur
		Texas	3	College Station - A&M College
		Wyoming	1	Sheridan City Park
1922	8	Mississippi	2	City of Jackson
		New York	2	B.P.O.E. 3 - Utica
		Oklahoma	1	Platt NP
		Texas	3	B.P.O.E. 151 - Houston
1923	49	Ohio	2	Toledo Park
		Texas	3	College Station - A&M College
		Utah	44	State of
1924	51	Idaho	45	State of 42
				State Elks Assoc. 3
		Pennsylvania	6	Gen. H. C. Trexler-Allenstown
1925	13	Illinois	10	Willow Springs, 1st Preserve
		Missouri	1	W. W. Johnson - Mexico
		New York	2	Perrysburg Memorial Hospital

1926	78	Florida	2	Jacksonville Park	
		Idaho	60	Shoshone Rod & Gun Club	
		Ohio	2	Cleveland Park	
		Pennsylvania	7	Gen. H. C. Trexler-Allenstown	
		Michigan	6	Detroit Zoological Park	
		Texas	1	B.P.O.E.-Houston	
1927	103	Arizona	55	State of	
		Florida	1	Jacksonville Park	
		Colorado	12	Buena Vista	7
				Denver	3
				Grand Junction	2
		Michigan	2	Detroit Zoological Park	
		Missouri	1	W. W. Johnson - Mexico	
		Montana	32	State of - Libby area	
1928	182	Arizona	63	State of - Phoenix	
		Montana	117	Judith River Rod & Gun	85
				State of - Havre area	32
		Utah	2	State of - Price	
1930	110	California	43	R. Nadeau - Saugus	31
				Vail Company - Wilmington	12
		Idaho	30	Izaac Walton League - Moscow	
		Indiana	1	Wm. J. Asplan - Evansville	
		Ohio	2	Canton Park Commission	
		Pennsylvania	2	Gen H. C. Trexler-Allenstown	
		Washington	30	Izaac Walton League - Dayton	
		Wyoming	2	Bighorn Sheep Co. - Lysite	
				Buffalo Bill campgr.,-Cody	
1931	2	Indiana	2	Columbian Park Zoo - Lafayette	
1932	37	Michigan	2	James N. Garber - Detroit	
		Nevada	32	White Pine County - Ely	
		Pennsylvania	2	Gen. H. C. Trexler-Allenstown	
		Wyoming	1	Buffalo Bill Campground-Cody	
1933	2	Texas		J. H. Turbeville-Archer City	
1934	11	Montana	9	Frank Z. Hazelbaker-Dillon	
		Tennessee	2	Grace Mem. Hsp. - Bristol	
1935	375	Idaho	40	Idaho State	
		Montana	248	Crow Indian Agency	150
				Beartooth Fox Farms - Red Lodge	4
				Gr. Falls Wldlf. Assoc.	70
				Lewis & Clark Rod & Gun	24
		Virginia	56	State Game Dept. - Pearisburg	
		Utah	31	Dixie Nat'l. Forest - Cedar City	

1936	522	Idaho	126	State Game Dept.
		Montana	384	Crow Indian Agency
		South Dakota	11	Pine Ridge Indian Agency
		Wisconsin	1	Chippewa Falls City Zoo
1937	169	Argentina	2	Buenos Aires Zoological Gardens
		Idaho	74	State Game Dept.
		Montana	91	Anaconda Sportsmen's Assoc. 77
				W. L. Hughes - Wise River 14
		Minnesota	2	M. M. Youngman - Sleepy Eye
1938	214	Argentina	1	Buenos Aires Zoological Gardens
		Idaho	100	Bonner Sports. Assoc. 20
				Fremont F&G Assoc. 20
				Shoshone Sports. Assoc. 60
		Montana	113	Beaverhead Sports. Assoc.-Dillon
1939	296	Argentina	1	Jardin Zoo - Buenos Aires
		Idaho	76	Shos. Co. Sports. Assoc.-Wallace
		Illinois	1	Forest Pres. Dist.-Cook County
		Montana	218	Anaconda Sports Club 57
				Rocky Mt. Sports Assoc. 152
				Oxbow Ranch-Wolf Creek 9
1940	16	Montana	16	Rocky Mt. Sports Assoc. - Butte
1941	11	Montana	11	Rocky Mt. Sports. Assoc.-Butte
1942	127	Argentina	2	Jardin Zoo - Buenos Aires
		Idaho	1	City of Idaho Falls
		Montana	85	Rocky Mtn. Sports Assoc. 60
				Sportsmen - Knowlton 25
		North Dakota	26	Town Criers - Killdeer
		Oregon	10	C. V. Barton - Klamath Falls
		Wyoming	3	Sheridan City Zoo
1944	9	Montana	8	Warren L. Hughes - Wise River
		Wisconsin	1	City of Marshfield
1946	70	Idaho	56	State of - Murphy area
		Oregon	12	C. V. Barton - Klamath Falls
		Utah	2	Salt Lake City Zoo
1947	74	Michigan	54	E. B. Butters - Coldwater
		Missouri	1	M. B. Skaggs - Branson
		Oregon	18	C. V. Barton - Klamath Falls
		Wisconsin	1	Chippewa Falls City Park

1948	34	Georgia	2	J. F. Wellborn - Rock Springs
		Montana	12	W. E. Brogan - Corwin Springs
		Oregon	20	C. V. Barton - Klamath Falls
1949	47	Mexico	30	Humberto Garza - Dominguez,Monterey
		Oregon	17	C. V. Barton - Klamath Falls
1950	316	Montana	310	Fish and Game Dept.
		Ohio	6	R. B. Ridenous - Mansfield
1951	312	Montana	297 1/	Fish and Game Dept. 294
				See 'em Alive Zoo -Red Lodge 3
		Missouri	12	Tyson Valley Park - Clayton
		North Dakota	2	Fish and Game Dept.-Turtle Mtn.
		Washington, D. C.	1	National Zoological Park
1952	563	Mexico	85	Jaime F. Garza, N. L. 30
				Humberto Garza-Dominguez 30
				Miguel Aleman(Ramon Llano)25
		Iowa	3	Howard Hall - Cedar Rapids
		Montana	318 2/	Fish and Game Dept. 316
				Wonderland Zoo-Billings 2
		New Mexico	109	Fish and Game Dept. 1
				G. H. Vaughn - Dallas 108
		South Dakota	20	Hill City Zoo
		Wisconsin	28	E. J. Showalter - Jackson 16
				John Pettera-Prairie du Chien 12
1953	165	Montana	165	Fish and Game Department
1954	207	Montana	103 3/	Fish and Game Department
		New Mexico	104	State of (Gila NF) 16
				G. H. Vaughn - Chama 50
				Tobe Foster - Capitan 38
1955	585	Indiana	29	Lake Motor Frt. Line - So. Bend
		Minnesota	3	Pine Grove Park - Little Falls
		Montana	321 4/	State of
		New Mexico	187	State of 107
				Tobe Foster - Capitan 80
		Mexico	30	Bienes Mexicanos - Monterey
		South Dakota	15	Hill City Zoo - Rapid City

1/ Not included in elk shipped Montana are 69 elk released on Phelps Creek near Gardiner, Montana, harvested partially by hunters following release.
2/ Not included in elk shipped Montana are 629 elk released on Phelps Creek.
3/ Not included in elk shipped Montana are 74 elk released on Eagle Creek.
4/ Not included in elk shipped Montana are 8 elk released on Eagle Creek.

1956	645	California	2	Mr. Guzzardi - Encino
		Montana	185	State F sh and Game Department
		New Mexico	458	State Fish and Game 120
				W. J. Gourley - Taos 300
				Tobe Foster - Capitan 38
1957	214	Montana	64	State Fish and Game Department
		New Mexico	150	W. J. Gourley - Vermijo Park
1958	(90) (Gallatin)	Montana	90	State Fish and Game Department
1959	319	Indiana	3	Maynard Niemeyer - Terre Haute
		Kansas	15	August Lalouette - Florence
		Montana	274	Montana Fish & Game 269
				Anaconda Zoo 5
		Ohio	4	Chester Beer - Mansfield
		Oklahoma	18	Harry McCollough - Enid
		Pennsylvania	5	Rachelwood Wildlife Preserve
1960	135	Montana	135	State Fish and Game Department
1961	141	Idaho	2	Taupthaus Park - Idaho Falls
		Montana	92	State Fish and Game Department
		North Dakota	26	Emanuel Staiger - Hebron 20
				Bismarck Zoological Society 6
		Pennsylvania	2	Rachelwood Wildlife Preserve
		Texas	19	Leakey Tumbling Water Refuge
1962	297	Montana	206	Montana Fish and Game
		Nebraska	3	Omaha Zoo
		North Dakota	5	Bismarck Zoo
		Pennsylvania	2	Rachelwood Wildlife Preserve
		Wyoming	81	State Game and Fish Department
1963	671	Montana	295	State Fish and Game Department
		Wyoming	376	Game and Fish Commission
1964	1,243	Arizona	50	Flagstaff Zoo 10
				Hualapai Indians-Peach Springs 40
		Minnesota	2	Mankato Zoo
	(Gallatin) 377	Montana	518	Dept. of Fish and Game
		North Dakota	9	Bismarck Zoo
		New Mexico	42	Clovis City Zoo 2
				Chama Land & Cattle Co. 40
		Pennsylvania	2	Rachelwood Wildlife Preserve
		Texas	90	Tumbling Water Refuge, Leakey
		Wyoming	530	Game and Fish Commission

1965	665	Michigan(release)	82	P. C. Christiansen,Phelps,Wisc.
		Minnesota	2	Zoo, Little Falls
		Montana	239	Department Fish and Game
		New Mexico	140	Fish and Game Department 100
				R. A. Canning - Roswell 40
		Texas	200	Tumbling Water Refuge (O. J. McCullough)
		Virginia(release)	2	Arthur Godfrey, New York City
1966	1163	Idaho	21	Idaho Falls Zoo 2
				W.E.Arrington, Idaho Falls 3
	(Gallatin)			LaGrande Wadsworth,Monteview 16
		Illinois	6	Ray Dieter, Hines
		Michigan(release)	196	P.C.Christiansen,Phelps,Wisc.
	(Gallatin)	Montana	162	Don Larson, Boulder 3
	(Gallatin-64)			Department Fish and Game 155
	(Gallatin-31)	New Mexico	358	Fish and Game Department 238
				R.A. Canning, Roswell 40
				Mescalero Apache Ind.Tr. 80
		North Dakota	48	Bismarck Zoo 13
				Harold Schafer, Medora 35
		South Dakota	25	Ronald Krogman, White River 20
				Claude Levtzow, Rockham 5
		Texas	226	Joe Brown, Houston 40
				O. J. McCullough, Utopia 126
				J. E. Rose, Leakey 60
		Utah	100	Ute Indian Tr.,Ft.Duchesne 100
	(Gallatin)	Wyoming	21	Game and Fish Commission

Yellowstone National Park
Wyoming

LONG-RANGE WILDLIFE AND HABITAT MANAGEMENT PLAN FOR YELLOWSTONE NATIONAL PARK

Introduction:

The following management plan for Yellowstone National Park considers several animal species, covers many facets of animal behavior and ecology, and in some cases reflects visitor management.

Basically, Yellowstone National Park is involved in four kinds of wildlife management programs that are necessary to carry out the mission of the Park as stated in the Organic Act creating the National Park Service. These programs are:

1. Management carried out to protect rare and endangered animal species and those species that require solitude, certain ecological conditions, or that have other specific requirements for maintaining satisfactory populations: i.e., trumpeter swans, grizzly bears, etc.

2. Management of wildlife for the protection of the park visitor, park employees and their property: i.e., bear management.

3. Management of certain dominant wildlife species to preserve their habitat and to assure the wellbeing of other animals that use this habitat: i.e., elk, bison, etc.

4. Management of those animals that involve a "pest" problem in developed areas of the Park: i.e., ground squirrels, mice, etc.

The long-range management of different species and their habitat in the above four divisions is presented as follows:

1. Management carried out to protect rare and endangered animal species and those species that require solitude, certain ecological conditions, or that have other specific requirements for maintaining satisfactory populations.

Objective: To insure the perpetuation of rare species.

Grizzly Bear - Present studies indicate a static population probably in balance with their available habitat. Any habitat destruction or removal of these animals over the years in excess of the numbers presently destroyed because of undesirable and dangerous habits in relation to the park visitor could result in their eventual decimation.

Program:

a. To weigh carefully the impact of future development on important grizzly habitat in the Park, especially relative to campgrounds, roads, and trails and to adequately warn visitors through proper signing of the dangers of travel in grizzly concentration areas. It is realized that some control of animals directly involved with park visitors and their property will be necessary. Every effort will be made to take management measures necessary to minimize undesirable bear-visitor encounters and the number of grizzly bears that must be destroyed because of these encounters.

b. Complete ecological studies of this animal presently being carried out.

Trumpeter Swan - Yellowstone National Park is one of the most important nesting areas of the trumpeter swan, which today in the United States number only 723, increasing from a low of 69 in 1932.

Program:

a. To assure maximum reproduction of this rare bird by protecting known nesting areas from excessive human disturbance during the critical nesting and post nesting periods. Fishing season dates, fisherman, and over-all visitor use will be evaluated in those water areas that have produced cygnets over the period for which records are available. In some instances it may be necessary to adjust fishing seasons and/or regulate visitor use of some areas while swans are nesting and the young are developing.

b. Plans for developments such as trails, roads, and campgrounds will be reviewed carefully to insure that they do not infringe upon the known habitat of this rare species.

2. Management of wildlife for the protection of park visitors, park employees and their property.

Objective: To provide the opportunity for the park visitor to see bears as nearly as possible under natural conditions, while minimizing the visitor's exposure to personal injury or damage to his property.

Black Bear - Over the past 33 years bear incidents involving property damage or personal injury have varied from 9 to 427 incidents annually and have averaged 154. Past management has involved extensive education programs; improved garbage cans and collection of garbage; enforcement of regulations prohibiting feeding; live trapping or drugging of troublesome animals for release in remote areas; relocation of bears to interested zoos; and, as a last resort, killing of those individuals that are involved in numerous incidents.

Program:

a. Continue educational programs warning the visitor; improve enforcement of regulations that prohibit bear feeding; provide all garbage cans with bearproof tops; work toward improvement of garbage disposal methods; remove habitual, continual troublemakers either by translocation, shipment to zoos, or permanently by killing when necessary; improve management through application of knowledge gained from contract studies that will be started in the spring of 1965 and studies being carried out by park personnel (weekly roadside censuses, keeping records of bear incidents, etc.).

3. Management of certain dominnant wildlife species to preserve their habitat and to assure the wellbeing of other animals that use this habitat: i.e., elk, bison, etc.

Objective: To attain a balanced relationship between plants and animals and between different species of animals, thus providing an optimum opportunity for the park visitor to observe and enjoy wildlife and plant resources of Yellowstone National Park under conditions which will reflect healthy animals in an appealing, natural environment.

Management of species under this heading primarily concerns the ungulates of the Park. Due to the complexity of inter-species relationships and geographic boundaries limiting movement and range availability, the long-range management programs for these animals are considered on the basis of species involved within a geographic area to which they may be limited by habits or by habitat restriction.

Northern Yellowstone Winter Range - The winter range includes a maximum area of about 120,000 acres in the northern half of Yellowstone National Park east of the Gallatin Mountain Range. This area, when reduced to a minimum because of severe winter conditions, comprises less than 90,000 acres. Studies relative to range and the animal populations in this wintering area have been carried on in varying intensities for over 40 years. All facts from these studies have indicated an overpopulation of ungulates, and control programs have been carried out since the early 1900's. The species most dominant and most successful in competition for limited winter forage are elk and bison. The antelope population, because of very limited winter range and food preferences, has also had to be controlled. Ungulate species most adversely affected by overuse of winter range and least able to compete with elk and bison have been the Rocky Mountain bighorn and the whitetail and mule deer.

The following programs make up the long-range plans for management of the individual species:

Elk: Range studies carried on over a period of 30 years indicated that the Northern Yellowstone elk herd was far in excess of the numbers the available winter range would support. Authorization for removal of elk by killing in the Park by park personnel was first received from the Director, National Park Service, in 1934. Since that time various management programs have been carried out to reduce elk numbers by encouraging hunter harvest north of the Park, by live trapping and shipping elk, and by direct killing by park rangers.

In 1949 the first soundly thought out management program for the Northern Yellowstone elk herd was approved, with a goal of reducing this herd to 5,000 animals in the hope that this might be a number which would allow the range to improve and would maintain satisfactory conditions for competing species. Antelope and bison were included in this management plan as regards reducing their numbers.

The approximate goal of 5,000 elk on the Northern Yellowstone range was not reached until the winter of 1961-62, 12 years after the program had been approved. Intervening years had resulted in herd reductions, which were never completely successful due generally to adverse weather conditions. This lag in effecting the needed reduction also allowed further range deterioration.

Program:

a. Maintain the Northern Yellowstone elk herd at a maximum of 5,000 animals for a period sufficient to determine the response of vegetation. When vegetation response has been determined through recognized methods of study, the elk of the Northern Yellowstone herd will be maintained in numbers not to exceed the carrying capacity of their winter range with due consideration given other species of wildlife competing for this range. No artificial feeding shall be introduced.

b. Continue to recognize hunter harvest north of the Park as the most desirable means of controlling elk numbers, and elk migration out of the Park will be facilitated whenever possible. During those years when weather conditions are such that large numbers of elk leave the Park, the State will be encouraged to cooperate in removing animals through hunter harvest well below the maximum 5,000 figure, thus giving hunters the opportunity of removing these animals when they are available. When hunter harvest outside the Park does not achieve the needed herd reduction, elk will be removed from the Park by live trapping and shipment. If both hunter harvest and live trapping and shipment fail to achieve the needed herd reduction, shooting of elk by park rangers will be done as necessary.

c. Removal by shooting of small bands of elk which display no interest in moving out of the Park and which habitually damage vegetation in inaccessible and key areas may be required, even though the herd numbers approximately 5,000 animals.

d. Manipulate control methods applied in the Park where possible to encourage migratory habits of elk consistent with the programs of the U. S. Forest Service, Montana Fish and Game Commission, and the Wyoming Game and Fish Commission and considering interests of landowners in the Upper Yellowstone Valley.

e. Arrange to check population trends and estimates by helicopter censuses every three years.

f. Carry out the necessary long term studies of trends in habitat conditions and forage production and utilization that will provide the basis for evaluating the management program, for determining habitat carrying capacity, and for determining annual herd reduction requirements.

g. Develop and institute a comprehensive ecological study of Yellowstone National Park which will include: (1) the evaluation of the response of plants and animals to changing range conditions; (2) elk migration studies, and studies on elk productivity, food habits, soil capabilities and many other ecological factors. Some of these studies have been underway for some time. Cooperative research studies with state agencies and other Federal agencies are already in force. These will be expanded to develop all possible information, not only on the range but also on population dynamics, related animal diseases, and other biological factors that affect the inter-relationship of the various animals to their range.

h. Continue cooperation with state and Federal agencies as set out in the "Cooperative Management Plan for the Northern Yellowstone Elk Herd and Its Habitat".

Bison: As a part of the over-all ecological picture and as a major user of available food on the Northern Yellowstone winter range, bison will be managed both from the standpoint of balancing numbers with habitat and other species as well as from the standpoint of minimizing the occurrence of brucellosis in this herd. Herd control has been carried out for many years, and present management plans provide for a maximum of 125 on the Northern Yellowstone winter range.

Program:

a. Live trap bison in the Lamar-Slough Creek area to the maximum extent possible with existing facilities.

b. In cooperation with the Division of Disease Eradication of the Department of Agriculture, test all bison for reaction to the agglutination test for brucellosis.

c. Remove those animals which the above test indicates are suspect or that are positive reactors.

d. Furnish carcasses to Indian tribes and agencies as specified in FO 8-64 and/or through local agreements with Bureau of Indian Affairs area offices.

e. Mark for future identification all animals released.

f. Vaccinate, mark, and release all calves.

g. If the above action does not result in the removal of a sufficient number of bison to attain management goals based upon range conditions and inter-species relationships, continue to remove animals to attain these goals.

Antelope: This species is marginal in Yellowstone because of limited winter habitat. There are few, if any, for 50 miles down the Yellowstone Valley north of the Park. It is a native animal of considerable interest to the park visitor and should be managed carefully to insure its survival. Estimated population of 800 in the 1930's has decreased from natural causes and through herd reduction to about 350. This decrease reflects serious deterioration of winter range (primarily browse). The population is more or less static or possibly on the decrease and winter browse use is still excessive. The decrease closely follows predictions by Adolph Murie in his book, "The Ecology of the Coyote in Yellowstone." With the possibility of mule deer increasing, studies are needed to determine competitive food habits of these two species on critical winter range. Meanwhile, it is imperative that every measure be taken to reduce and hold antelope numbers to the 125 maximum as outlined in previous management plans.

Past reductions of antelope have been made through cooperation in live trapping these animals with the State of Montana.

Program:

a. Make every effort to hold antelope numbers at 125 head until the response of their critical winter range can be evaluated; then adjust the number of antelope and other ungulates using this range so that proper range use is achieved and range conditions improve.

b. Initiate food habit studies of the antelope and the mule deer. Evaluate antelope-mule deer relationships and their relative impact on critical antelope winter range.

c. Investigate the possibility of benefiting the antelope and their habitat by manipulating mule deer populations that use critical winter range.

d. Continue to gather population information through field observations and periodic censuses.

Mule Deer: During the past years of high elk overpopulation, mule deer have generally left the Park during the winter. Now, with the elk herd controlled, it is possible that increasing mule deer could prevent desired range recovery on the Northern Yellowstone winter range.

Program:

a. Accumulate information on deer numbers, distribution, productivity, and population trends on the Northern Yellowstone winter range.

b. Evaluate mule deer-antelope-elk relationships and their relative impact on critical antelope winter range.

Rocky Mountain bighorn sheep: This animal is comparatively rare in the United States and has dwindled greatly in numbers in Yellowstone National Park and vicinity during the past 50 years. In areas of critical importance to bighorn sheep, management activities should favor this species whenever possible.

Program:

a. Initiate ecological studies of the Rocky Mountain bighorn sheep in Yellowstone National Park.

b. Remove elk competition through selective live trapping or killing of elk on critical Northern Yellowstone mountain sheep winter range.

Upper Gallatin Winter Range:

In 1929, Public Law 888 was passed altering the northwest boundary of Yellowstone National Park to include the Specimen, Black Butte, and Daly Creek drainages. Prior to that time the State of Montana recognized indications of overgrazing in this area. In 1923 it was estimated that 75 percent of the grass and 100 percent of the aspen and willow had been utilized in the Daly Creek drainage and adjacent Teepee Creek drainage outside the Park. Studies by the National Park Service, U. S. Forest Service and the Montana Fish and Game Department show present range conditions to be continually deteriorating.

Only about 7,000 acres of National Park Service lands are involved, since elk usually move north of the park boundaries by January 1 or earlier. During mild winters several hundred animals remain on the northern edge of the Park, existing where it would seem impossible. Attempts by the Montana Fish and Game Commission to reopen the hunting season after the elk have left the Park have met with strong local opposition. In 1964 Yellowstone National Park personnel live trapped and shipped 377 elk to the State of Montana from this critical area. Presently an estimated 2,000 elk occupy this critical winter area.

Program:

a. Maintain the Upper Gallatin elk herd at a maximum of 1,000 animals for a period of time sufficient to determine the response of vegetation on critical winter range. When vegetation response has been determined through recognized methods of study, the elk of the Upper Gallatin will be maintained in numbers not to exceed the carrying capacity of their winter range. No artificial feeding shall be introduced.

b. Continue to recognize hunter harvest north and west of the Park as the most desirable means of control, and encourage State cooperation in the setting of hunting seasons and achievement of harvests which will aid in accomplishing this objective.

c. Live trap and remove elk from the Upper Gallatin areas of the Park when it appears that maximum hunter harvest is not possible, and will not achieve the desired reduction.

d. Manipulate control methods applied in the Park where possible to encourage migratory habits consistent with the programs of the U. S. Forest Service and the Montana Fish and Game Commission.

e. Continue cooperation with the State and Federal agencies as set out in the "Cooperative Upper Gallatin Elk Herd Management Plan," dated March 1961, and the cooperative studies agreement dated September 15, 1961.

f. Continue studies of range trend, forage utilization, and elk use on critical winter range in the Park. The results of these studies and those carried out by cooperating agencies will provide the basis for evaluating the long time effects of our management program and for formulating annual management programs.

Firehole and Upper Madison Winter Range: For a number of years Yellowstone National Park personnel have recognized signs of serious depletion of browse species and excessive use of lodgepole pine and other usually unpalatable food species in this area. Some limited direct elk reduction has been carried out. Resident elk seem to be getting more numerous, and attention must be given this area.

Program:

a. Determine important elk wintering areas, and evaluate range conditions, trends, and animal impact on these areas.

b. Initiate studies of elk migration patterns in the Firehole-Madison River area by observing marked animals.

c. Periodically census elk in the Firehole-Madison River area and determine distribution patterns during the winter.

d. Work closely with the Montana Fish and Game Commission to arrive at a cooperative solution to the management of this relatively small elk herd if such a solution proves to be feasible.

Hayden Valley-Nez Perce-Firehole Winter Range: Hayden Valley contains remnants of the last original wild bison found in the Park. Superintendent's Reports of the early 1900's indicate that this herd once numbered as few as 25 animals. Under protection the herd had increased until it has seriously damaged its habitat which it shares with elk in the summer.

A range site-condition survey made in cooperation with the Soil Conservation Service the summer of 1964 shows 326 acres (1%) in poor condition (producing less than 25% of climax potential) and 6,800 acres (31%) in fair condition (producing less than 50% of climax potential). Much of the good to excellent range is unavailable for bison use during most winters.

This herd moves freely over Mary Mountain between Hayden Valley and the Nez Perce and Firehole Valleys, both winter and summer. Over the past 20 years herd reductions have been made through both shooting and live trapping. This herd is presently estimated at over 600 animals. Management plans in the past have indicated a maximum number of 165 for this area. New studies are being initiated to give us more information as to trends and condition of the range in this area.

Program:

a. Reduce the bison herd that winters in this area to 165 animals and maintain the herd at this level until habitat responses can be evaluated.

b. In cooperation with the Division of Disease Eradication of the Department of Agriculture, test all bison for reaction to the agglutination test for brucellosis.

c. Remove those animals which the above test indicates are suspect or those that are positive reactors.

d. Furnish carcasses to Indian tribes and agencies as specified in FO 8-65 and/or through local arrangement with the Bureau of Indian Affairs area offices.

e. Mark for future identification all animals released.

f. Vaccinate, mark, and release all calves.

g. If the above action does not result in the removal of a sufficient number of bison to attain management goals based upon range conditions and inter-species relationships, continue to remove animals to attain these goals.

h. Carry out studies of range condition and trend and animal impact on critical range areas and thermal features in order to evaluate the long term effectiveness of the management program and to provide information for furmulating annual management programs.

Pelican Creek Valley Winter Range: This winter range of about 6,000 acres is used only by bison during the winter, and by elk migrating to and from the northern winter range in late fall and early spring. General range observations for a number of years have indicated a problem in this area. In the winter of 1955-56 118 bison were removed from the Pelican Creek Valley winter range.

A range site-condition survey made in cooperation with the Soil Conservation Service the summer of 1964 shows 922 acres (7%) in poor condition (producing less than 25% of climax potential) and 6,174 acres (48%) in fair condition (producing less than 50% of climax potential). Much of the good to excellent condition range is unavailable for bison use during most winters.

It is believed that the bison using this range move freely and intermingle with the Lamar bison. For all practical purposes they could be considered one herd, except for the weather barriers which prevent cross country movement after winter has set in. Thus, the number of bison wintering in Pelican Valley could vary considerably from year to year.

By carrying out controls on the bison in Pelican Creek Valley during winter, these animals can be kept at a population which will allow improvement in their critical winter range.

An attempt will be made to minimize brucellosis in these bison as part of our management.

Program:

a. Manage bison, through direct reduction by shooting, on the Pelican Valley winter range.

b. Test all bison killed for brucellosis.

c. Keep records on above findings.

d. Destroy entrails of those animals which react to brucellosis test.

e. Furnish carcasses to Indian tribes and agencies as specified in FO 8-64 and/or through local arrangement with the area Bureau of Indian Affairs offices.

f. Carry out the necessary long term studies of trends in habitat conditions and forage production and utilization that will provide the basis for evaluating the management program, for determining habitat carrying capacity, and for determining annual herd reduction requirements: i.e., continue movement and population studies of bison in the Pelican-Lamar areas now being partially supported by National Park Service funds.

4. Management of those animals that involve a "pest" problem in developed areas of the Park: i.e., ground squirrels, mice. etc.

Objective: To protect public health and property and landscape values, thus increasing visitor enjoyment of the Park.

Program: To provide for control of animals, primarily rodents, in residential and concentrated use areas within such regulations set up by the Secretary's Federal Pest Control Review Board and National Park Service policies and regulations.

Recommended:

/s/ John S. McLaughlin 9/23/64
Superintendent, Yellowstone National Park

Concurred:

/s/ Lon Garrison 10/9/64
Regional Director, Midwest Region

Approved:

/s/ Howard W. Baker 10/20/64
Actg. Director, National Park Service

A COOPERATIVE MANAGEMENT PLAN FOR THE

NORTHERN YELLOWSTONE ELK HERD AND ITS HABITAT

PART I

History and Problem:

Since early in the 20th Century the large herd of elk known as the Northern Yellowstone herd has been of concern to conservationists throughout the West, as well as to the National Park Service and the adjacent States of Montana and Wyoming.

Historically this elk herd summered primarily in Yellowstone National Park. When cool fall weather and early winter snows began, elk migrated north down the Lamar and Yellowstone River drainages. Many elk left the Park near Gardiner where they became available to hunters. However, since the early 1900s the periodic failure of elk to leave the Park and the buildup of interior herds resulted in large concentrations of elk on very limited winter range. The undesirable impact of these elk concentrations on their habitat soon reached serious proportions and persons and agencies responsible for land resources in Yellowstone National Park and adjacent National Forest and private lands became concerned.

Studies of the elk and their relationship to the range and to other important species of wildlife began before 1920 and are continuing today. Studies have shown continuous overuse and abuse of the Northern Yellowstone winter range and l ss of soil due to erosion.

In 1934 the National Park Service, realizing the seriousness of the situation, authorized direct killing of elk in Yellowstone National Park to alleviate this downward trend of the Northern Yellowstone range. Continuous studies have resulted in management plans and action programs that have been revised annually by the National Park Service.

Partial control of the Northern Yellowstone elk herd has been accomplished in cooperation with the Montana Fish and Game Commission through proper hunting season manipulation in areas north of the Park. In addition, live trapped elk have been stocked on suitable areas in many western states, particularly Montana and Wyoming. Since nearly all land available for stocking elk is under the jurisdiction of either the U. S. Forest Service or the Bureau of Land Management, their cooperation has been vital. Since 1934, when direct killing was first authorized in the Park, 67,440 elk have been removed from the Northern Yellowstone herd. Of these, 41,400 have been taken by hunters north

of the Park, 6,733 have been live shipped from the Park, 13,753 have been killed within the Park boundaries by Park Service rangers, and 5,541 have been recorded as dying from the combined impact of severe winter weather conditions and lack of forage on deteriorated winter range. It was not until the winter of 1961-62 that the management goal of approximately 5,000 elk in the Northern Yellowstone elk herd was achieved. Since then, through the cooperative efforts of the National Park Service, Montana Fish and Game Commission, Wyoming Game and Fish Commission, the Forest Service, the Bureau of Land Management and Indian agencies the herd has been kept at this approximate level (5,000). Continued range studies will determine whether or not this number will allow range recovery. The goal, meanwhile, is to maintain the herd so as not to exceed the 5,000 level.

Part II

AGENCY POLICIES

1. National Park Service:

The animals indigenous to the parks shall be protected, restored, if practicable, and their welfare in a natural wild state perpetuated. Their management shall consist only of measures conforming with the basic laws and which are essential to the maintenance of populations and their natural environments in a healthy condition.

2. Montana Fish and Game Commission:

To produce and maintain a maximum breeding stock of big game on all suitable lands of Montana, public and private, in harmony with all other uses of such lands, and consistent with the available forage supply, and to utilize, through public hunting, the available crop of big game produced annually by this breeding stock.

3. Wyoming Game and Fish Commission:

To produce and maintain a maximum breeding stock of big game animals on all suitable lands of Wyoming, public and private, in harmony with all other multiple uses and consistent with the available forage supply. To utilize to its maximum extent, through public hunting, the available big game animals annually produced by this breeding stock.

4. U. S. Forest Service:

The Forest Service recognizes that responsibility for elk stocking rests with the states. In order to assure coordination of uses,

the Forest Service will determine the appropriateness of individual projects. Regional Foresters are authorized to approve big game stocking projects upon recommendation or after consultation with the Forest Supervisors concerned. Each state cooperative agreement should provide for concurrence of the Forest Service before any stocking is undertaken.

Breeding stock now exists on most National Forest areas where elk production and management is desirable. It rarely will be necessary to build up additional supplies of elk by artificially stocking. Of more importance is the determination and correction of environmental or other factors that limit the natural increase. Consideration will be given to conflicts with other uses and the needs for resting or restoring the habitat through lighter use. Limited numbers of non-diseased elk may be stocked where low population breeding herds exist, after agreement for a joint study program is reached with the responsible state agency to determine both the effects on native herds and the migratory habits of the stocked animals. The agreement will also provide for herd controls to keep populations in balance with the habitat.

This policy does not provide for widespread stocking without individual study agreements. Future stockings will depend on individual study findings.

PART III

Objectives:

To so maintain the elk and other wild ungulates using the winter range of northern Yellowstone National Park and adjacent National Forest lands that the basic soil and vegetative resources are allowed to improve where this critical winter range is in a depleted condition, and to maintain this resource in a satisfactory condition in areas not yet so depleted.

PART IV

Program:

To accomplish the stated objectives, Yellowstone National Park will carry on the following program:

1. Continue and intensify studies for evaluating range conditions and trends in northern Yellowstone National Park.

12. Prior to the initiation of the live trapping and transplanting program, Yellowstone National Park will meet with agencies requesting live elk to discuss the financing and mechanics of the operation (helicopter costs, handling of elk, etc.) so it can be accomplished with maximum efficiency.

To accomplish the stated objectives, the Montana Fish and Game Commission will carry on the following program:

1. Continue cooperative migration studies with Yellowstone National Park, U. S. Forest Service and Wyoming Game and Fish Commission.

2. Intensify range studies for evaluation range conditions and trends north of Yellowstone National Park on the winter range of the Northern Yellowstone elk herd.

3. Continue cooperative elk physiological studies in cooperation with Yellowstone National Park and Montana State College.

4. Cooperate in helicopter census of the Northern Yellowstone elk herd, being responsible for the count of that recognized segment of this herd which may be wintering outside of Yellowstone National Park in the State of Montana.

5. Encourage hunter harvest of elk north of and adjacent to Yellowstone National Park as needed by:

   a. Manipulation of seasons through extensions or reopenings

   b. Manipulation of bag limits when studies indicate the necessity.

6. Make every effort to find areas with satisfactory range conditions for the release of live elk from Yellowstone National Park.

To accomplish the stated objectives, the Wyoming Game and Fish Commission will carry on the following program:

1. Continue cooperative migration studies with Yellowstone National Park and the Montana Fish and Game Commission.

2. Participate to the extent possible on studies being carried out on the Northern Yellowstone elk winter range, and make this information available to other cooperators.

3. Encourage hunter harvest of elk east of Yellowstone National Park as needed, if facts indicate that this practice will help reduce the number of elk that winter on the northern portions of Yellowstone National Park and adjacent National Forest lands in Montana.

4. Endeavor to find suitable areas for release of live elk from Yellowstone National Park.

To accomplish the stated objectives, the U. S. Forest Service will carry on the following program:

1. Continue to aid in the cooperative elk migration studies by recording neckband observations.

2. Carry out studies as needed for evaluating range conditions and trends on National Forest portions of the Northern Yellowstone elk herd winter range.

3. Cooperate with the States of Montana and Wyoming in existing and future agreements concerning the transplanting of elk from Yellowstone National Park.

PART V

COOPERATIVE AGREEMENT

Memorandum of agreement, made by and between the Montana State Fish and Game Commission; the Wyoming Game and Fish Commission; the Regional Forester, Northern Region, U. S. Forest Service for Regions One, Two and Four; and the Superintendent, Yellowstone National Park, U. S. National Park Service, WITNESSETH:

WHEREAS; the objectives and program of the Cooperative Management Plan for the Northern Yellowstone Elk Herd and its Habitat are compatible with the spirit and purposes of all parties to this agreement,

NOW THEREFORE, it is mutually agreed that:

1. All parties to this agreement will take necessary actions within the areas of their responsibilities to accomplish the objectives and to implement the program of the Cooperative Management Plan for the Northern Yellowstone Elk Herd and its Habitat.

2. All agencies involved will cooperate in an objective public relations program, whereby public hunting outside the Park

will be emphasized as the most desirable means of accomplishing management objectives. Joint news releases covering committee actions will be issued following committee meetings, or as otherwise agreed upon. Separate agency public relations programs to achieve the purposes of this agreement are encouraged.

3. It will be the responsibility of the Superintendent of Yellowstone National Park to call an annual joint meeting of the four cooperating agencies. This meeting will be called in the spring each year, preferably during the month of May. The purpose of this meeting will be to review current progress, to exchange and disseminate information, to coordinate activities, prepare work plans and to discuss the necessary herd harvest. Interested land management agencies, sportsmen's and other conservation groups will be invited to participate in these discussions.

4. That nothing in this agreement shall be construed as obligating the agencies concerned to expend or as involving them in any contract or other obligation for the future payment of money in excess of appropriations authorized by law.

5. That no Member of or Delegate to Congress or Resident Commissioner shall be admitted to any share or part of this agreement or to any benefit to arise therefrom.

6. That in connection with the performance of work under this agreement, the parties thereto agree not to discriminate against any employee or applicant for employment because of race, religion, color, or national origin.

7. That each and every provision of this cooperative agreement is subject to the laws of the States and the laws of the United States, and the regulations of the Secretary of Agriculture and the Secretary of the Interior.

8. Admendments to this Cooperative Management Plan for the Northern Yellowstone Elk Herd and its Habitat may be proposed by any party, and shall become effective upon approval by all parties.

9. This memorandum of agreement shall be subject to agreement by all parties and shall become effective upon approval by all parties and will remain in full force and effect until cancelled by any of the parties advising the others, in writing, at least ninety (90) days in advance of such intended cancellation.

U. S. NATIONAL PARK SERVICE

Date 12/12/63

By /s/ Lemuel A. Garrison
Superintendent Yellowstone National Park

MONTANA FISH AND GAME COMMISSION

Date 12/16/63

By /s/ W. E. Staves
Chairman

WYOMING GAME AND FISH COMMISSION

Date 1/3/64

By /s/ S. J. Jiacoletti
(Title) State Game and Fish Commissioner

U. S. FOREST SERVICE

Date 12/23/63

By /s/ Boyd Rasmussen
Regional Forester

UNITED STATES DEPARTMENT OF THE INTERIOR

YELLOWSTONE NATIONAL PARK

NATIONAL PARK SERVICE

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Yellowstone National Park, Wyoming December 6, 1966

YELLOWSTONE NATIONAL PARK ELK MANAGEMENT PROGRAM

1966-1967

Management Plans for the Northern Yellowstone Elk Herd have been firmed up after consultations and studies by the National Park Service, Montana and Wyoming Game and Fish Departments and the U. S. Forest Service, according to Park Superintendent John S. McLaughlin. The agencies concerned all recognize that hunter harvest outside the Park is the most desirable and priority method for reducing the herd.

Plans call for the removal of about 3,000 elk this winter from the Northern Yellowstone Elk Herd to keep it within the winter range carrying capacity. Light snowfall last winter resulted in achieving only half the desired reduction. Few elk moved out of the Park, and those inside were widely scattered. Low hunter harvest outside the Park and poor live trapping success within the Park resulted. Winter mortality was low, and a good calf crop was produced this spring. Thus, the need for a larger than average reduction this coming winter. Unless realistic efforts are made to keep the herd at the proper level, it could rapidly reach a size much greater than the winter range can support. Gains made the past four winters through reduced grazing pressure could be quickly lost. Last winter was the first since 1961 that the reduction goal was not achieved. Every effort will be made this winter to reduce the number of elk to the recommended herd size.

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YELLOWSTONE NATIONAL PARK ELK PROGRAM

Regulations formulated by the Montana Fish and Game Department are designed to maximize hunter harvest when and if elk move out of the Park. However, elk movements are unpredictable and depend on weather conditions. For this reason live trapping for transplanting purposes will begin in the Park as soon as elk are near the traps. Successful trapping operations are also dependent on sufficient snow depth to form elk concentrations and to prevent their fleeing to forested, higher elevations. Trapping will be conducted so as to minimize adverse effects on elk movement out of the Park while at the same time assuring steady progress toward the reduction goal. As in the past, direct reduction by shooting in the Park will be initiated only if there is strong indication that combined removal by hunter harvest and live trapping will fail to meet reduction goals.

Elk are being taken for continuing biological studies conducted by the Montana Fish and Game Department and the National Park Service. Salvaged carcasses will be made available to various Indian Tribes through the Bureau of Indian Affairs.

In the northwestern corner of the Park, research studies indicate that between 600 and 700 elk should be removed from the Upper Gallatin elk herd during the current fall and winter period. However, new estimates of herd size may change this figure. A firm reduction goal will be established by early January.

Last winter only 70 percent of the desired reduction of the Upper Gallatin elk herd was achieved. This emphasizes the need to meet this year's goal of reducing the size of this herd to 1,000 animals, as called for in the

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YELLOWSTONE NATIONAL PARK ELK PROGRAM

Cooperative Upper Gallatin Elk Herd Management Plan agreed upon by the U. S. Forest Service, Montana Fish and Game Department and the National Park Service.

Herd reduction will be achieved by hunter harvest outside the Park through a reopened season when sufficient elk are available. Some elk from this herd may be trapped and shipped from the Park to reduce a non-migratory herd segment that habitually stays on critical Park ranges.

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UNITED STATES DEPARTMENT OF THE INTERIOR

YELLOWSTONE NATIONAL PARK

NATIONAL PARK SERVICE

★ news release

February 3, 1967

YELLOWSTONE'S ELK REDUCTION PROGRAM

Insufficient kill by hunters outside Yellowstone, and limited livetrapping success in the Park make it necessary to undertake field reduction of the Northern elk herd by shooting, Superintendent John S. McLaughlin said today. Relatively mild weather this winter and last year has made it impossible to get the required herd reduction by hunting outside and the usual livetrapping methods and this "last ditch" reduction method will be undertaken with utmost reluctance. The reduction will be started about February 13 if hunter take outside the Park does not increase considerably. Park Rangers will shoot the elk and the meat will be made available to Indian tribes in the vicinity.

The Superintendent said that direct reduction initially will be taken in remote parts of the Park and away from that segment of the herd that is most likely to drift out of the Park where the elk may be taken by hunters.

More than half the period has passed when elk can be removed from the herd. Current rates of hunter harvest and trapping success indicate that this winter's reduction cannot be achieved by these methods alone. About 1,250 elk have been removed out of a desired reduction of approximately 3,000 needed to keep the herd at 5,000 elk. As was the case last winter, conditions favorable for elk movement out of the Park have not occurred. Hunters have taken only about 250.

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Current plans call for removal of up to 600 elk by shooting in the Park. Should hunter harvest and trapping success improve significantly, fewer animals may have to be shot. Trapping efforts will continue unabated as will efforts to encourage elk movement out of the Park.

Ground and aerial observations indicate that many elk remain widely scattered in small groups where they are unavailable for livetrapping or hunter harvest. Good wildlife and habitat management requires that some elk be removed from these inaccessible ranges.

Elk taken in the Park will be distributed through the Bureau of Indian Affairs to Indian tribes. Optimum utilization of salvaged carcasses requires that elk be shot while they are still in good physical condition. Initiation of the program should not and cannot be delayed until the very end of the reduction period.

The Superintendent pointed out that failure to achieve necessary reduction of the Northern Yellowstone elk herd for several years could result in rapid herd increase to a level much greater than the winter range can support. Gains made the past four years through reduced grazing pressure could be quickly lost, and a heavy herd reduction such as occurred in 1961-62 might again be necessary unless steps are taken now to keep the herd at proper population levels.

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SUCCESSFUL LIVE TRAPPING OF ELK ON THEIR WINTER RANGE

ROBERT E. HOWE
PARK MANAGEMENT BIOLOGIST
YELLOWSTONE NATIONAL PARK

Introduction

Long before many people had thought about game management, Yellowstone National Park was live trapping elk for shipment to zoos and to various states for establishment of elk herds. In 1892, four elk were shipped to the National Zoological Park, Washington, D. C. This was the first recorded shipment from the Park. Shipments have been made nearly every year since that time, with the annual number varying from two to 671. In the early 1900's only two areas of Montana had elk in an appreciable number. These were the Upper Sun and the South Fork of the Flathead River, and the area adjacent to Yellowstone National Park. By the mid-fifties all suitable areas for elk in Montana were well stocked and emphasis shifted to management. Today Montana is one of the top three states in terms of elk hunter harvest. Most of the elk for re-establishing these herds came from Yellowstone National Park.

Prior to the winter of 1962-63, Yellowstone National Park trapped elk using the best known methods short of establishing a feed ground; that is, portable or stationary, wooden paneled traps, baited with second-cutting, salt cured alfalfa. Success was almost wholly dependent upon the vagaries of the weather. In addition, other animals such as bison, deer and moose often interfered with trapping operations. If bison or deer moved into a trap area, they consumed the bait as fast as it was put out and triggered the trap if it was set.

Experiences gained in the use of helicopters for moving and holding elk during our massive elk reduction in 1961-62 encouraged us to believe that such a method could be used to live trap elk, though similar methods had been tried superficially and unsuccessfully before. In early winter 1962, in fulfillment of a contract let for the live sale of bison in excess of the carrying capacity of the range, a pole corral was constructed in a wooded area at the end of a long meadow frequented by the Hayden Valley - Nez Perce herd. After unsuccessful attempts to "cowboy" bison into this trap, a Hiller 12E helicopter was employed. It had the necessary hovering ceiling (9,550 feet) to operate in the areas concerned, which varied from 7,500 to 8,500 feet. Three hundred and sixty two bison were successfully moved by helicopter into this trap. Some groups were moved as far as ten miles in a two day period. Five bison were lost due to injuries incurred in the trap and 357 were successfully live shipped.

With this success, and with information gained from the December 18 House Interior and Insular Affairs Sub-Committee hearings relative to the management of the Northern Yellowstone elk, we began experimental elk trapping

using helicopters to the fullest extent possible. Though we had three large permanent traps and two small portable traps in operation, using conventional "bait and wait" methods, by January 1, 1963 our success had been negligible. Trapping conditions were poor with very little snow and considerable available winter range for the elk.

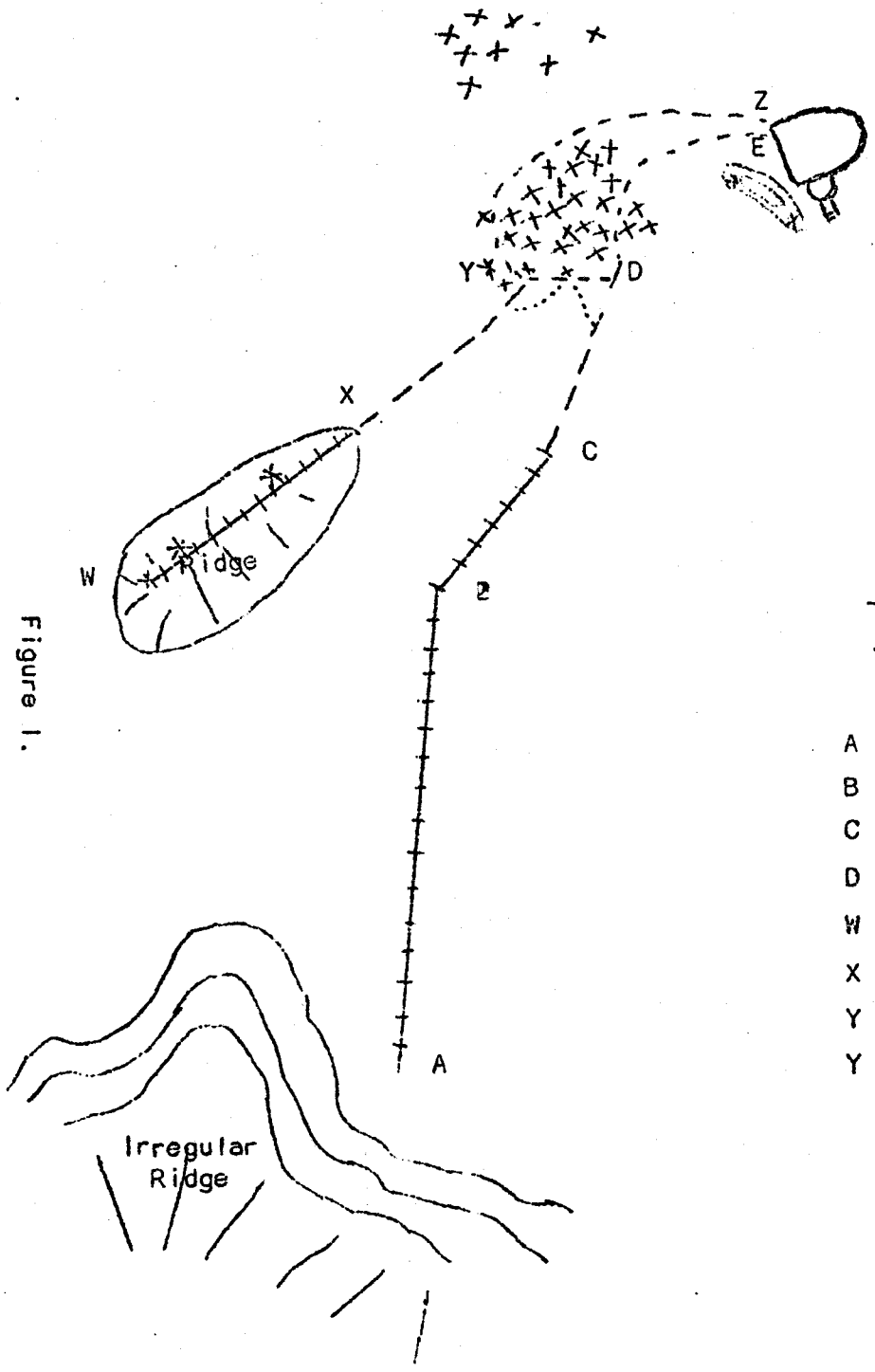
Helicopter trapping operations 1962-63

On January 8 we employed two Bell 47G3 helicopters to aid us in this trapping experiment. The Bell 47G3 has been most satisfactory for wildlife work in Yellowstone National Park. It operates efficiently at over 10,000 feet, and has a hovering ceiling of 18,000 feet plus. One pilot had had extensive experience and the other some experience in wildlife work in Yellowstone National Park. Pilots were included in planning meetings.

The first helicopter drive was to a regular portable type elk trap, altered only by the addition of wings to aid in controlling elk as they neared the trap entrance. Our portable traps vary from 60 to 80 feet in diameter with a trap entrance ten feet wide. Snow fence, two widths high for the first 100 feet from the trap entrance and continuing one width high for the remainder of the distance, was used for the wings. Generally, the length of the wings was determined by such geographical features as streams, ridges or trees. The two helicopters, each with pilot and observer, located a group of 35 elk about one mile above the trap. These animals were brought within about 100 yards of the wings when they started to scatter. The helicopters brought 16 into the wings and when these were within 200 feet of the small trap entrance, they bolted in all directions, even though the helicopters were within 20 feet of the ground. Minor alterations were made to this and other portable traps, but all attempts to drive elk into them failed. It was evident that elk could not be driven through a small opening into what was obviously a dead end enclosure.

The next trial centered around an old tree nursery of about 12 acres, enclosed by a seven foot woven wire fence. A considerable number of trees and tall shrubs furnished cover inside this enclosure. After erecting a 300 foot snow fence wing from one corner of this enclosure, 39 elk were successfully driven through a 100 foot opening in the fence opposite the wing. The opened section of fence was manually replaced and the trapped elk were driven by men on foot into a smaller enclosure from which they could be loaded into trucks for shipment.

After this successful experience, two portable traps were erected near natural elk travelways, and where ridges and aspen stands camouflaged both the traps and the approaches to them. The first trial at the Slough Creek trap (Figure 1) resulted in a successful drive. The second trap of similar design was constructed in an inaccessible area (Little Buffalo Creek) and was to be used primarily for neckbanding elk for migration studies. All construction materials for this trap were transported to the trap site by helicopter, an airline distance of two and one half miles.



SLOUGH CREEK TRAP
1963

SNOW FENCE

WOVEN WIRE FENCE
(9 gauge)

A - B	935'
B - C	185'
C - D	280'
D - E	300'
W - X	125'
X - Y	400'
Y - Z	400'
Y - D	70'

Figure 1.

Generally, these traps were successful because elk could enter the wing guides without feeling trapped, and the aspen stands that concealed the traps seemed to offer a safe avenue of escape from the helicopters.

The eight foot high, woven wire sections of the wings were designed to give the elk a feeling of freedom as they approached the trap entrance. The woven wire fence that made up the actual outer trap was eight feet high and quite unnoticeable among the aspen. To give this fence strength and to make the wire trap more visible when the elk were inside, we added two by six planks along the top and center of the wire enclosure. The gates of the outer wire trap were pipe frame with woven wire.

Drives into this type trap yielded as many as 200 elk per drive. Depending upon distance from the trap and difficulty in handling, the drives lasted from 13 minutes to 1.2 hours. One helicopter usually maneuvered 150 feet above and slightly behind the main group of elk and moved laterally as necessary. The other helicopter picked up stragglers and aided on the flanks. Often the two aircraft changed position. When the route of the elk drive approached patches of timber, one helicopter would usually hover over the timber to keep elk from moving into it or to control their movement through it. One helicopter was equipped with a loudspeaker, and a series of yells or a burst of song at a crucial time further helped to keep the elk moving where desired. Once the elk were in the mouth of the wings, both machines pushed them rapidly into the wire enclosure and landed. The observer and pilot shut the outer gates securely and then walked slowly through the wire enclosure forcing the elk into the wooden trap and closing these gates.

Elk were driven distances of four to five miles in the light snow conditions of the winter of 1962-63. About 1,400 elk were live trapped by this method. Of these, 300 escaped due to weaknesses in the traps that largely resulted from the experimental nature of the operation and winter construction difficulties. In one case, because nine gauge wire was not available, 12 gauge wire was used. Elk surging against this lighter wire soon broke through. In mass alone, any number of elk over 100 posed a threat of escape and accounted for some loss due to trap breakage. Under more normal, deeper snow conditions, it is likely that the elk would tire much quicker and tend to stop movement. Such conditions would affect the distance elk could be moved and the amount of flying time needed to move them.

Trapping costs

Because trap relocation, construction, and modification were done in mid-winter, costs were abnormally high. A temporary bridge had to be constructed for access to one trap, and generally difficult construction conditions prevailed with deep snow cover, frozen ground and sub-zero temperatures. For these reasons, and because of the experimental nature of initial traps, construction costs incurred are not representative of those to be expected now that the traps have been more or less perfected. Helicopter experimental drives, helicopter transport of trap construction materials

to an otherwise inaccessible site, and the driving of elk to traps for neckbanding purposes accounted for $3,620 worth of flying time at the rental rate of $100 per hour. These costs were paid with National Park Service funds, and are broken down as follows:

Experimental trapping (prior to January 15)	$ 630
Trapping for neckbanding and release	520
Transport of personnel and construction material to Little Buffalo trap site	2,470

Actual helicopter costs for driving animals into traps for live shipments out of the Park were paid by the receiving agencies. This amounted to $1,880 for 671 elk, or an average helicopter cost of $2.81 per elk.

Management implications

Presently Yellowstone National Park is undertaking a cooperative elk migration study with the Wildlife Research Unit at Montana State University. It will extend over a period of at least two years, and the trapping procedures described here are being used to facilitate neckbanding large numbers of elk. From this study we hope to be able to define movements of herd segments, both area and time wise. The present location of our two accessible traps may be such that we can remove animals from the different herd segments by properly timing the trapping of elk as they migrate past the Slough Creek trap, or as they arrive on the lowest winter range within the Park at Stevens Creek. Modification of a permanent trap near Gardiner, Montana, may allow us to relieve pressure on the critical lower range east of the Gardiner River. Present knowledge of Northern Yellowstone elk migration encourages this idea, but facts learned from studies mentioned above may result in a change in our plans.

Better knowledge of herd segments, their summer and winter locations, as well as their migration routes, may show a need for more traps in different areas or trap relocations, if proper consideration is to be given to range conditions on specific areas of summer and winter range.

Live trapping of elk by the method described is, in itself, "sex selective," as shown in the table below:

Trapped Herd Composition

Year	Method	Bulls	Cows	Calves	Sample Size
1960-61	Bait and wait	31%	38%	31%	165
1961-62	Bait and wait	25%	49%	26%	471
1962-63	Helicopter drive	8%	63%	29%	1,061

Large groups of elk on their winter range are usually made up of cows and calves and few bulls. These large groups are more economical to move and are generally in more accessible areas at lower elevations. Also, the helicopter pilots have learned that large groups of 100 or more elk are much easier to control than small groups of 20 to 50 animals.

If live trapping and transplanting is to be extensively used to control elk numbers, what effect will this "sex selectivity" have on the Northern Yellowstone elk herd? Will the resulting higher percentage of bulls to cows in the herd merely cause reproduction to be less than maximum? This would be good from the Park's standpoint, since the goal is to control numbers of elk on the northern range. Are there other effects of this unbalanced sex ratio which could be detrimental to the elk when considered in the light of other National Park Service objectives?

Information is being compiled from our migration studies, range studies, population observations, and our extensive cooperative biological collections made from five elk taken weekly. When carefully analyzed, this material should provide Yellowstone National Park and cooperating agencies answers necessary for an effective live elk trapping program in the Park and a maximum hunter harvest outside the Park.

CONFLICTS IN RECREATION--ELK VERSUS ASPEN IN YELLOWSTONE NATIONAL PARK[1]

William J. Barmore, Biologist
Yellowstone National Park

Introduction

I'm sure many of you have heard about Yellowstone National Park's elk problem--it's nothing new. It has been giving park administrators headaches for about 50 years, and chances are good it will continue to do so for some years to come. My discussion will deal with one of the more serious aspects of the problem: The impact of excessive numbers of elk on the aspen community and, in turn, on primary park esthetic, recreational, and scientific values.

The Origin of Yellowstone's Elk Problem

Even though Yellowstone National Park contains over 3,000 square miles, man's activities in and around the Park have altered its pristine ecology. Disruption of primeval relationships between ungulates and their habitat has been one of the more serious consequences.

Yellowstone provides adequate summer range for elk and other ungulates, but the high mountains and plateaus are largely unavailable during long, cold winters when deep snow buries forage and impedes travel. In primeval times elk migrated to lower elevation winter ranges in foothill valleys surrounding the Park where forage was more easily available. The Northern Yellowstone elk herd probably migrated far down the wide Yellowstone River valley north of the Park, perhaps as far as Livingston, Montana, or beyond (Skinner 1928, Bailey 1930, Grimm 1939, Cahalane 1941 and 1943, Murie 1951). Then the lowland valleys were developed for agriculture and livestock production. Heavy and unrestricted hunting decimated migratory herds. Elk simply could not cope with man the developer and man the hunter. They were forced to winter on previously marginal ranges in and near the Park.

Public concern about decimation of big game herds throughout the West led to strong protective measures--nowhere stronger than in Yellowstone National Park. Beginning in the late 1800's the herd increased to an estimated 35,000 in 1914, far more than the winter range could support. The inevitable occurred. Deterioration of vegetation and soils was accompanied by heavy winter mortality that reached as high as 14,000 during the winter of 1919-20. After this the herd never exceeded 15,000.

The problem was recognized in the early 1900's (Graves and Nelson 1919, Rush 1932), but early efforts to solve it through "bait and wait" trapping methods, live shipments, hunter harvest outside the Park, and

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[1] Presented at the Twentieth Annual Meeting of the American Society of Range Management, Seattle, Washington, February 13-17, 1967.

by shooting elk in the Park were never equal to the job. Effective herd control has been achieved only since 1961 through determined administrative action and development of better methods for removing elk--such as herding them into traps with helicopters (Howe 1963). Thus, from the early 1900's through the 1950's, habitat deterioration continued almost unabated. The aspen community was one of the hardest hit.

Elk and the Decline of Aspen

Aspen (Populus tremuloides) probably was limited in extent even in primeval times. A 1903 survey of over 2,000,000 acres of forest and grassland immediately north of the Park revealed that aspen and cottonwood made up less than 2 percent of the vegetation (Leiberg 1904). In the 1930's only about 6.6 percent of the Northern Yellowstone winter range was mapped as pure aspen or aspen mixed with conifers and grassland. It covers even less area now.

Aspen is most abundant in the northern quarter of the Park along the forest-grassland ecotone. Unfortunately, its distribution closely coincides with the present limits of elk winter range. Aspen typically occurs in small groves or narrow belts along the ecotone or as small, isolated stands in the grassland. The largest stand of pure aspen mapped in the 1930's covered about 185 acres, but single stands of mixed aspen-conifers covered up to 565 acres. Today, even the largest stands are much smaller. Although aspen grows on all slopes and exposures, best development is reached on moist, level sites where trees nearly 2 feet in diameter and over 80 feet tall can be found. However, mature trees in most groves are considerably smaller.

We know that aspen, elk, and other ungulates were part of the primeval ecosystem when modern man first visited the Yellowstone region in the early 1800's. Long before then some kind of dynamic, but harmonious, equilibrium must have developed between aspen and ungulate populations. At least some aspen stands were relatively healthy as late as the 1920's. A beaver study conducted in 1921-23 indicated that aspen and beaver were abundant along most streams in the Tower Fall area. Photographs show heavy cutting of overstory trees, but abundant and vigorous aspen reproduction in these cutover areas. No mention was made of excessive browsing (Warren 1926).

The declining condition of aspen first became apparent or was first mentioned in the late 1920's. After that, the rate of decline increased rapidly. Some loss of aspen can be explained by natural succession to coniferous forest. Control of natural wildfires may have accelerated this process. But by the early 1930's it was recognized that the very existence of aspen on the Northern Yellowstone winter range was threatened by heavy overbrowsing. Aspen reproduction was browsed down and bark was stripped from older trees, killing many and scarring the rest. Annual range reports from the 1930's through 1958 refer almost without exception to excessive browsing by elk and the unremitting deterioration

and disappearance of stands. In the 1950's re-examination of the status of beavers in the Tower Fall area (Jonas 1955) revealed no sign of beaver where an estimated 200 had lived in the early 1920's. Aspen along the streams and ponds had all but disappeared. Beavers eliminated the older trees and elk took care of the reproduction. Heavy browsing of remaining aspen reproduction by elk prevented normal re-establishment of aspen stands along streams that would eventually permit beaver to move back into the area.

By 1962 the status of aspen was at a low point. Some groves had entirely disappeared, others were nearly gone, and most of those remaining were in very poor condition. Aspen reproduction was completely suppressed by overbrowsing, and the bark of older trees was scarred, roughened, and blackened as high as elk could forage. The only age classes present were decadent, overmature trees and young, browsed-off root sprouts. The demise of older trees was probably hastened by disease and insect infestations introduced through elk-damaged bark. A normal, healthy aspen stand could not be found anywhere on the winter range.

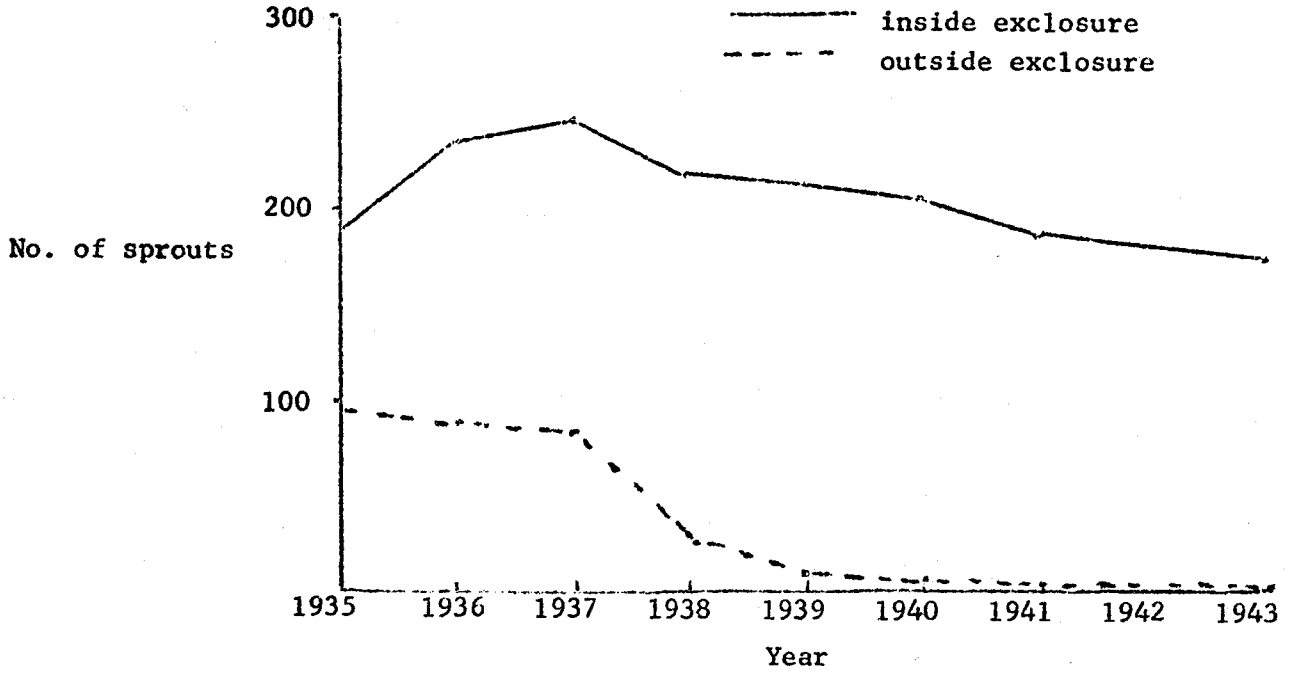
Conceivably, factors such as adverse climatic changes, disease and insect attacks, alteration of the primeval fire regime or these factors combined with heavy browsing caused the decline of aspen. Exclosure studies dating back to the early 1930's help clarify this point.

An exclosure near Mammoth Hot Springs contained about 190 root sprouts and an equal sized unprotected plot contained about 100 in 1934. All were suppressed by excessive browsing to an average height of less than 15 inches (Figure 1). By 1941 protected sprouts increased over 400 percent to 82 inches in average height. Unprotected sprouts remained suppressed to about 18 inches and declined in numbers from 97 to 2. In 1965 the exclosure contained 86 trees up to 5 inches in diameter and 36 feet tall, but only 5 sprouts browsed off to less than 2 feet tall survived outside.

At another site aspen grew up inside an abandoned hay enclosure during the 1920's. In 1936 half the protected stand was exposed to browsing. During the first winter after exposure foliage was eaten from the unprotected trees as high as elk could reach, and bark was stripped from the trunks. By 1941 all but 5 of the original 86 trees outside the exclosure were dead. Even though their crowns were beyond reach, elk killed the trees by eating off the bark. In 1965 the exclosure contained 100 trees up to 7 inches in diameter and 57 feet tall. The unprotected plot contained 136 root sprouts, but all were less than 2 feet tall because of excessive browsing.

Similar results have been obtained from larger exclosures constructed in 1957 and 1962. Data on sprout height, density, and pattern have been obtained from permanent belt transects 5 feet wide and 75 to 100 feet long inside and outside the exclosures (Table 1).

Figure 1. Response of sprouts at Aspen Exclosure No. 10 (Data from National Park Service, 1943).



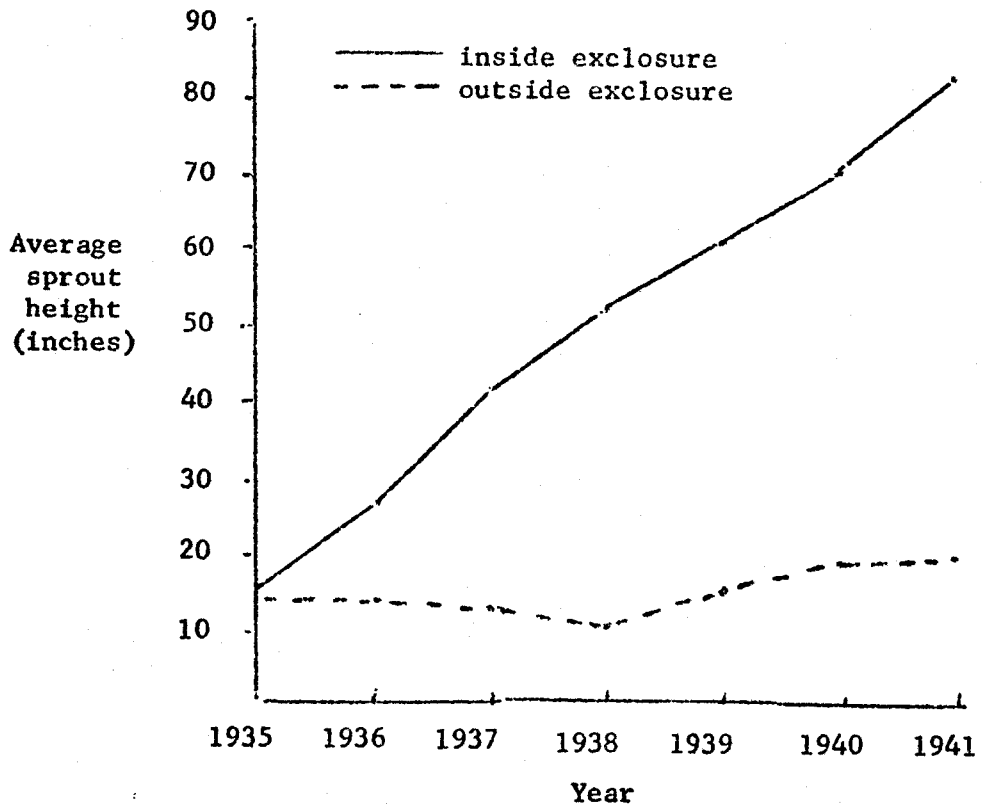


Table 1.--Response of aspen sprouts at three 5-acre exclosures on the Northern Yellowstone winter range.

Exclosure	No. of sprouts			Average height (inches)			Percent sprouts over 4' tall		
	1958	1962	1965	1958	1962	1965	1958	1962	1965
Lamar									
Protected	40	44	31	25	43	86	None	43	77
Unprotected	49	47	55	16	15	16	None	None	None
Mammoth									
Protected	78	37	30	23	36	43	3	24	34
Unprotected	141	47	70	15	10	13	None	None	None
Junction Butte									
Protected	--	24	22	--	10	34	--	None	18
Unprotected	--	47	44	--	8	15	--	None	None

At the Lamar exclosure protected sprouts increased from 25 to 86 inches or 200 percent in average height between 1958 and 1965. Unprotected sprouts did not gain in height. In 1958 all sprouts were less than 4 feet tall. By 1965 77 percent of the protected sprouts were over 4 feet tall, and some were 10 to 12 feet tall. All unprotected sprouts were still under 4 feet. Their continued suppression was correlated with heavy browsing. During the winters of 1964 and 1965, 67 and 80 percent respectively of the available twigs were browsed.

At the Mammoth exclosure protected sprouts increased from 23 to 43 inches or 87 percent in average height between 1958 and 1965, with no corresponding increase for unprotected sprouts. Sprouts over 4 feet tall increased from 3 to 34 percent inside the exclosure, but all unprotected sprouts were still under 4 feet tall in 1965. Suppression was again correlated with heavy browsing.

Both protected and unprotected sprouts increased in average height at the Junction Butte exclosure between 1962 and 1965, although protected sprouts gained twice as much. All sprouts were under 4 feet tall in 1962. Three years later 18 percent of the protected but none of the unprotected sprouts were over 4 feet tall. The gain in height of unprotected sprouts is correlated with lighter browsing than at the other two exclosures (56 and 63 percent twig use for 1964 and 1965 respectively).

Sprout density declined on protected plots at all three exclosures. None contained any one year old sprouts when remeasured in 1962 and 1965. Termination of all browsing apparently results in cessation of

all or most root sprout production. Decline in density on protected plots results from mortality of older sprouts, possibly in response to increased intraspecies competition.

In contrast, sprout density changes on unprotected plots have ranged from a 12 percent increase to a 50 percent decrease. From 9 to 22 percent of the living sprouts on these plots were sprouts of the year. This continual production of new sprouts, apparently stimulated by browsing, partially offsets mortality from browsing and other factors. Sprout density on unprotected plots seems to be holding its own at the Lamar and perhaps the Junction Butte exclosures, but has declined significantly at the Mammoth exclosure.

Several important conclusions can be drawn from these exclosure studies: (1) They conclusively show that overbrowsing has been the primary reason for the deterioration and loss of aspen. Regardless of the effects of other environmental factors, even decadent aspen stands respond quickly and favorably when released from browsing. (2) They show that root sprouts can slowly reinvade areas where aspen has nearly disappeared from overuse. (3) They show that aspen recovery requires more than just allowing reproduction to grow beyond the reach of elk. Browsing pressure must be kept low enough to prevent elk from killing young trees by eating the bark. (4) They indicate browsing is beneficial to aspen because it stimulates root sprout production. However, browsing must be low enough to permit some sprouts to grow into trees.

Aspen Response to Herd Control

During the winter of 1961-62 the Northern Yellowstone elk herd was cut in half from about 10,000 to 5,000 animals. The herd has been held at approximately this lower level since then. Aspen studies have been intensified to (1) evaluate the annual impact of ungulates and other environmental factors on aspen, (2) to determine the response of aspen to better control of the elk herd, and, if possible (3) to determine proper use levels for aspen.

Spring and fall data have been gathered from 50 to 100 sprouts on plots in 20 typical aspen groves scattered over the winter range. Ungulate impact is determined from estimates of percent leader use and severity of hedging according to methods modified from Cole (1963) and from pellet group counts. Aspen growth characteristics and its response to ungulate use are determined from measurements of sprout height and twig growth and from estimates of sprout density, annual production of new root sprouts, sprout decadence, rodent damage, etc. Changes are also documented by black and white photographs and colored slides.

Exclosure studies have shown that change in sprout height is one of the most sensitive indicators of aspen response to release from overbrowsing. Trends in sprout growth and ungulate use since 1962 are summarized in Table 2.

Table 2.--Aspen response on the Northern Yellowstone winter range after reduction of the elk herd in 1961-62.

	5 transects for 4 years				12 transects for 3 years			20 transects for 2 years	
	1963	1964	1965	1966	1964	1965	1966	1965	1966
Average percent twig use . . .	86	90	79	57	70	55	46	57	51
Average height (inches) . . .	14	14	16	16	21	20	21	19	20
Percent sprouts over 2' tall	3	2	1	9	28	21	26	22	23

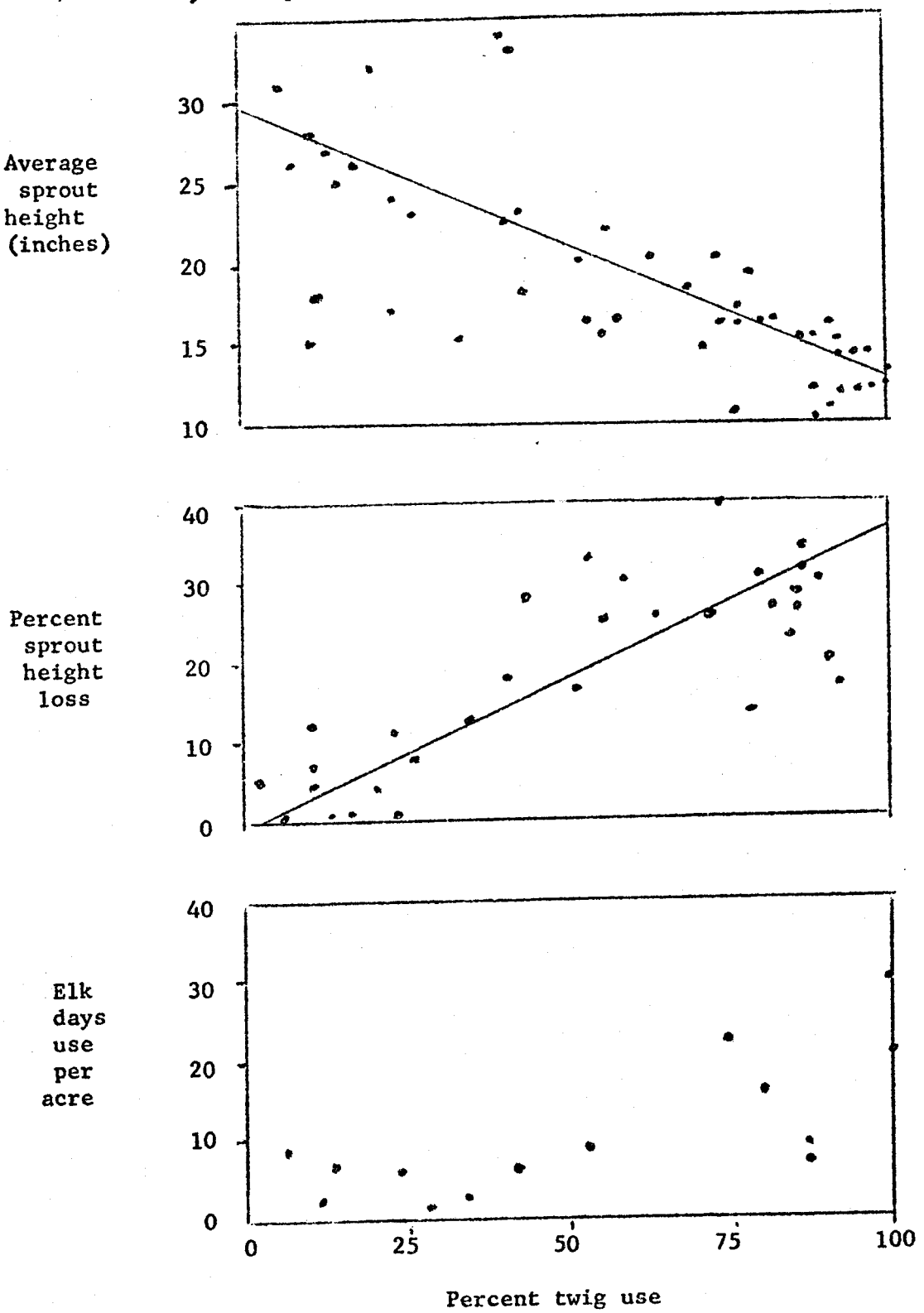
A static or downward trend in average sprout height and sprouts over 2 feet tall occurred through 1965. The winter of 1965-66 was the mildest since before 1961-62. This probably explains the suggestion of a slight and, perhaps, insignificant upward trend between 1965 and 1966. Coles (1965) found that an average growth rate of at least 0.4 feet per year for several years must be maintained to insure satisfactory development of young aspen. This has not occurred in any of the stands examined. At best the data indicate the groves are still in very poor condition with condition trend static.

Although a consistent downward trend in average percent twig use has occurred since 1962, browsing is apparently still too high to permit significant gain in sprout height. The best that can be said at this time about proper use levels for aspen is that no groves with more than 60 percent twig use have shown any increase in average sprout height or any increase from one fall to the next in the percentage of sprouts taller than 3 feet. However, some groves with much less twig use have also not shown any in rease.

Percent twig use is negatively correlated with average spring sprout height and positively correlated with fall to spring height loss expressed as percent of average fall sprout height (Figure 2). This strongly suggests that failure of sprouts to increase in height is due to browsing. A rough positive correlation between percent twig use and elk days use per acre (Figure 2) suggests that most of the browsing is by elk. No similar correlations were apparent for mule deer or moose. About 80 percent and 69 percent of the total animal days use in the winters of 1964-65 and 1965-66 respectively was by elk.

At no time has rodent damage occurred on more than 4 percent of the sprouts in a grove; therefore it is probably not a significant mortality factor. The impact of diseases and insects has not been adequately evaluated due to the difficulty of recognizing their effects. Dieback

Figure 2.--Relationship between aspen twig use and average sprout height, sprout height loss from fall to spring, and elk days use per acre.



of new, succulent growth may be of some significance. However exclosure studies indicate that these factors alone will not prevent at least some aspen sprouts from growing to maturity.

No quantitative data has been obtained from overstory trees, but photographs and general observations indicate continual thinning of the stands. No replacement in any groves has occurred for the last 30 years or more. Aspen is a fairly short-lived species (Fowells 1965, Baker 1925, Lynch 1955). Loss of overstory trees can be expected to increase at an accelerating rate as more and more enter older age classes. In the Rocky Mountain region establishment, maintenance and expansion of aspen groves is almost entirely dependent upon vegetative reproduction by root suckers (Baker 1925, Cottam 1954, Lynch 1955, Marr 1961). Loss of mature trees when combined with complete suppression of reproduction can be the death knell for entire groves (Fowells 1965). They will disappear with little or no chance of replacement. This has already happened to many groves in the Park, and unless present trends can be reversed, it will happen to many more.

Fortunately, a few mature trees remain in most groves, and they continue to put up root suckers. Since 1962, from 15 to 21 percent of all living sprouts have been sprouts of the year. New sprout production has ranged as high as 64 percent and has been present in all stands every year.

Sprout density in the groves studied ranges from a low of about 400 to a high of 22,200 per acre, and has averaged between 3,000 to 4,000 per acre the past 3 years. Approximately 2,500 to 4,000 sprouts per acre at the end of 3 to 5 years are considered necessary for proper stand regeneration (Baker 1925, Graham, Harrison and Westell 1963). According to these criteria, 11 or 58 percent of 19 stands were understocked in 1966, many seriously so.

In summary, since 1962 the condition of 70 percent of the groves examined has not improved due to continued suppression of reproduction by excessive elk browsing. Lack of improvement in another 25 percent is apparently due to factors other than browsing since 1962, although their poor condition may still reflect heavy abuse prior to then. Distinct improvement has occurred in only one grove, and this has been in response to reduced browsing. These conclusions apply to the majority of groves on the Northern Yellowstone winter range. However, sprout growth has improved in some groves along highways and near developed areas.

The Value of Aspen to Elk

Aspen is considered one of the more palatable browse species, particularly during the winter (Murie 1951, Packard 1942, Cowan 1947). In Yellowstone aspen is potentially important to elk only in late fall through spring.

During the summer most elk migrate beyond the main distribution of aspen. Obviously, in its present deteriorated condition, aspen provides little winter forage for elk. But what is its potential value? How important was it in primeval times? Answers to these questions are highly relevant to proper management of a national park, and perhaps to the well-being of elk.

Elk food habits as shown by analysis of 334 rumens are summarized in Table 3. During the severe winter of 1961-62 about 10,000 elk came onto the winter range. About 6,500 came onto the winter range during the mild winter of 1962-63. Elk had a greater opportunity to express forage preferences in the latter winter. Grass made up 65 to 90 percent of their diet. Browse, exclusive of conifers but including aspen, was consistently used throughout the winter but made up less than 8 percent of the forage consumed. Much heavier use of browse and conifers during the severe winter of 1961-62 suggests that grass forage was either depleted or became unavailable early in the winter, and elk were forced to utilize more browse and conifers until grass became available again in the spring.

Table 3.--Elk food habits during the severe winter of 1961-62 and the mild winter of 1962-63 as shown by rumen analysis.[a]

Month	Percent composition by volume							
	Conifers		Browse		Forbs		Grass and Grass-like	
	Severe winter	Mild winter	Severe winter	Mild winter	Severe winter	Mild winter	Severe winter	Mild winter
October	----	0.1	----	6.2	----	26.8	----	65.4
November	----	0.1	----	7.0	----	23.3	----	69.5
December	----	1.8	----	6.2	----	7.9	----	84.1
January	14.2	2.4	43.0	6.5	0.2	1.3	42.6	89.8
February	14.3	5.4	18.5	4.7	0.6	1.6	66.3	88.2
March	19.0	2.6	30.2	5.5	0.7	4.3	50.1	87.1
April	2.0	0.4	8.3	4.9	1.7	5.2	88.0	85.0
May	0.8	0.4	4.9	2.2	1.8	7.9	92.5	89.2
June	0.2	----	1.0	----	18.2	----	80.6	----

[a] Based on 334 rumens (148 in 1961-62 and 186 in 1962-63) with a minimum sample of 11 per month.

Table 4 shows that aspen made up a greater proportion of the elk's diet during the severe winter of 1961-62 than during the mild winter of 1962-63, both in volume and frequency of occurrence. In 1961-62 elk began utilizing aspen as soon as they moved onto the winter range in November. Use held fairly constant through March. Increased use in April and May largely reflected heavier use of aspen leaves rather than use of woody sprouts.

Table 4.--Seasonal variation of aspen[a] in the diet of elk as influenced by winter severity, Northern Yellowstone winter range.[b]

Month	Percent composition by volume		Frequency of occurrence	
	Severe winter 1961-62	Mild winter 1962-63	Severe winter 1961-62	Mild winter 1962-63
September	---	T	---	11
October	---	T	---	13
November	---	1.9	---	45
December	---	0.5	---	41
January	26.3	2.0	59	41
February	5.9	0.4	63	27
March	18.2	0.3	83	41
April	1.2	1.3	90	88
May	0.5	0.5	64	58
June	T	T	27	11

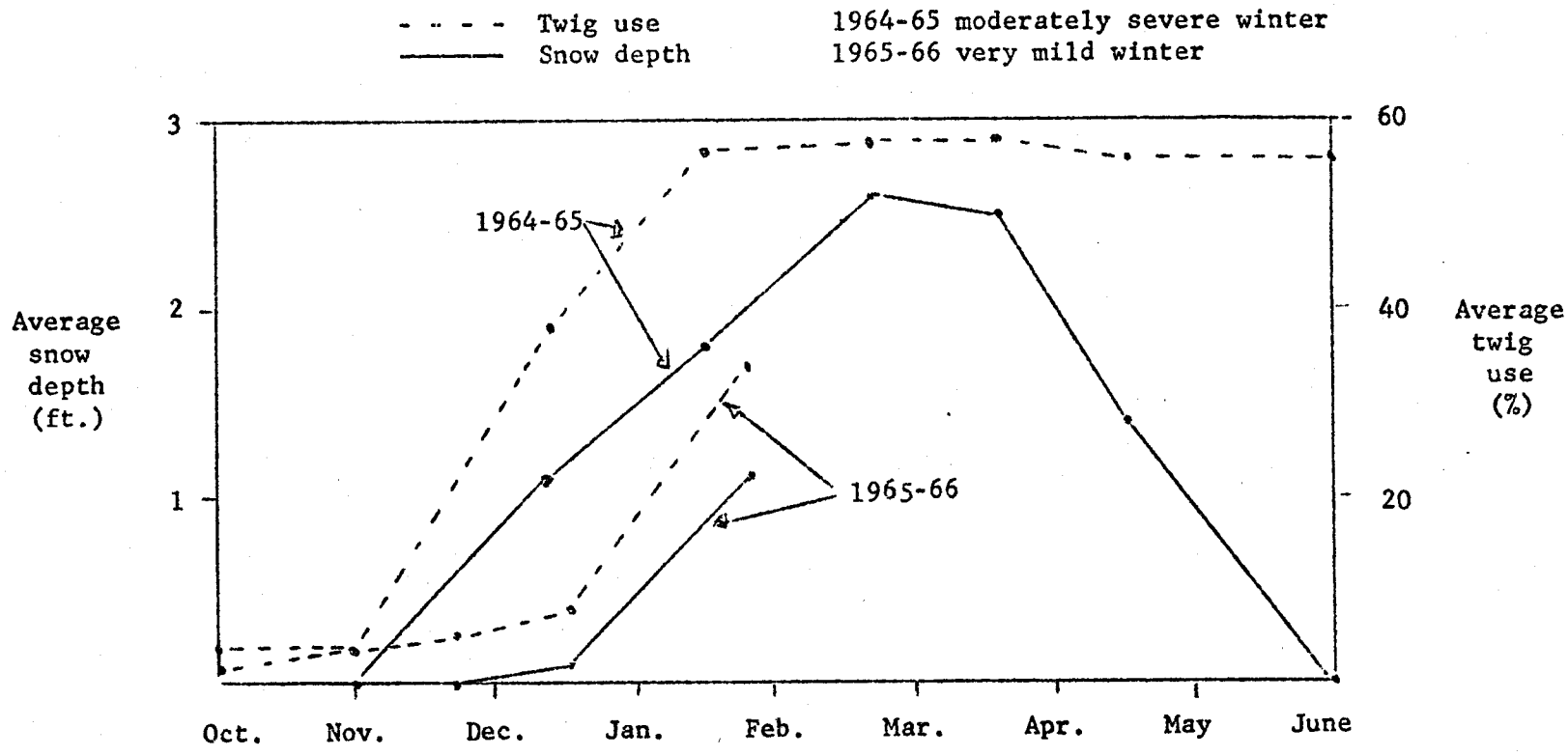
[a] Percentages are for Populus sp.. A very small amount of cottonwood may be included.

[b] Based on analysis of 334 rumens (148 in 1961-62 and 186 in 1962-63) with a minimum of 11 per month.

During the moderately severe winter of 1964-65, snow depth, sprout height, and percent twig use were determined at monthly intervals (Figure 3). These data show that aspen utilization began with the arrival of elk (late October in 1964-65, late November 1965-66) and permanent snow on the winter range. Use increased as snow depth increased. Elk began utilizing aspen in some areas when grass forage was easily available. By mid-January most aspen projecting above the snow had been fully used. This occurred before maximum snow depth and the most severe snow crusting conditions. Most aspen was either fully used or largely unavailable during late winter when it was needed most. Little use of woody sprouts occurred in the spring.

Some tentative conclusions can be drawn from these data. Aspen is of minor importance volume-wise in the winter diet of elk, but its fairly high frequency of occurrence in rumen samples throughout the winter indicates consistent use. On the depleted Northern Yellowstone winter range, elk seem to prefer grass over browse, including aspen. Aspen and other browse becomes much more important, perhaps critically so, during severe winters. Elk eat green bark and limbs from any aspen trees that fall in late summer or during the winter. This, plus early and heavy use of aspen every winter, suggests that elk require a certain amount of palatable browse in their winter diet. As a result of the current depleted condition of aspen and other preferred browse, practically all of it may be taken to provide these minimal needs. Thus

Figure 3.--Time and rate of aspen utilization in relation to snow depth, Northern Yellowstone winter range.



aspen may serve two important purposes: (1) Part of the minimal browse diet required by elk every winter; (2) emergency forage when grass is unavailable during severe winters. Under current conditions, aspen contributes little to the second purpose.

Mitchell (1951) questioned whether cured grass alone provided an adequate diet for elk under all conditions. He pointed out the many unknowns about the role of browse in ungulate nutrition and suggested the need to preserve existing browse until we find out. This argument seems particularly appropriate in Yellowstone National Park where aspen and other browse have many values besides forage for wildlife. But improvement in the condition of aspen and other browse may also be of key importance to the future well-being of the elk herd itself. At least the possibility seems strong enough to warrant preventing further loss of preferred browse.

Other Values of Aspen

Few people question the great esthetic and recreational value of elk, and some recognize the beauty and value of aspen. But how many would equate aspen with elk? After all, elk are warm-blooded; have big, understanding eyes; magnificent antlers; and move around with great dignity. Trees just stand there! However, in an area dominated by coniferous forest, aspen contributes disproportionately to the beauty and interest of the Park. It is the only deciduous tree of any major importance. Its growth form, light-colored bark, and the sight and sound of its leaves trembling in the breeze add a special charm to the summer landscape. Of course, during the fall aspen comes into its own. Splashes of gold pattern the slopes in sharp and beautiful contrast to the endless green of the conifers. Golden leaves falling and rustling underfoot add enchantment to a lazy stroll in the woods.

Besides its esthetic value, aspen contributes biotic variety to the Park. Groves have a rich quota of plant and animal life all their own. Trees provide nesting sites for a variety of birds, and at one time aspen was the mainstay for a larger beaver population. In primeval times it may also have played a more important role as food and cover for ungulates, particularly during the winter. Disappearance of whitetailed deer from the Park may have been linked to loss of aspen (Bailey 1930).

The Purpose of Yellowstone National Park

Now that we have taken a look at the history and current status of aspen and elk, let's consider this in relation to Yellowstone Park's reason for being. This is purely and simply to preserve the Park's outstanding natural features for the public's use, enjoyment and edification. The Secretary of the Interior's Advisory Board on Wildlife Management put this purpose in ecological perspective.

They stated that "The goal of managing national parks and monuments should be to preserve, or where necessary to re-create, the ecological scene as viewed by the first European visitors . . . . A national park should be a vignette of primitive America." (Leopold 1963). Under this management philosophy preservation of rare plant and animal species or minor biotic communities rightfully assumes greater importance than it would on lands managed for maximum production of consumable resources, such as timber and livestock.

Based on what we know about primeval conditions in the Park, both elk and aspen should be represented in the ecosystem. Full implementation of the management philosophy expressed by the Advisory Board and ultimate achievement of Yellowstone's purpose demands that these valuable components of the ecosystem be restored to their primeval status.

The Current Dilemma

Even though preservation of aspen is accepted as a valid and desirable goal, is achievement of this goal practical or even possible? It may not be. Prospects do not seem bright.

We are experimenting with prescribed burning to determine if it will increase aspen sprout density and vigor in decadent stands. Results of the first burn won't be known until next fall at the earliest, but encouraging results have been obtained in other areas. Fire may also prove useful for setting back succession in stands where conifers are gradually replacing aspen. Aspen is known as a "fire species." Use of fire as a management tool would be reintroducing a long suppressed environmental factor that might benefit aspen. Even is prescribed burning should prove beneficial and practical, reduction of elk browsing to a level that will permit aspen regeneration remains the key to success. Current studies suggest that we have not yet reached that point. How far do we need to go? How far <u>can</u> we go? This latter question has real meaning when dealing with a subject as emotional and controversial as management of the Northern Yellowstone elk herd. Can we afford to keep the herd at a level low enough to permit aspen regeneration? Can we afford not to? It is a 'damned if you do, damned if you don't' situation!

Consideration of the problem strictly from an ecological standpoint tells us that over-exploitation of an animal population that has seriously damaged its habitat is not nearly as serious as under-exploitation. An elk herd can rebound with astonishing and often embarrassing rapidity from a low level under improved habitat conditions, but plant communities can be literally wiped out by overuse. Recovery is often very slow. In the case of aspen, which is dependent on vegetative reproduction, there is little chance of replacement once existing stands are lost. After such a long period of abuse of vegetation and soils as has occurred on the Northern Yellowstone winter range, it would seem wise to favor the more fragile resource for a change.

While there is much we don't know about aspen ecology and aspen-elk relationships, and even though success cannot be assured, strong efforts to improve the condition of aspen are justified.

The following statement by Aldo Leopold in Round River (Leopold 1953) seems particularly appropriate to this problem.

> "The last word in ignorance is the man who says of an animal or plant: 'What good is it?' If the land mechanism as a whole is good, then every part is good, whether we understand it or not. If the biota, in the course of aeons, has built something we like but do not understand, then who but a fool should discard seemingly useless parts? To keep every cog and wheel is the first precaution of intelligent tinkering."

Intelligent and determined management may be able to restore the aspen community to its rightful place in the park ecosystem. Considering aspen's many values, it is a goal worth striving for.

Summary

The Northern Yellowstone elk herd increased to excessive size in response to man's disruption of the primeval ecosystem in and around the Park. Deterioration of vegetation and soils on winter range was the inevitable result. The aspen community was one of the hardest hit. Deterioration began in the 1920's and continued unabated through 1961. Overbrowsing suppressed aspen root sprouts and prevented replacement of overstory trees. Loss of overstory trees and the ability to put up new root sprouts resulted in the elimination of entire groves.

Exclosure studies show that overbrowsing and not other environmental factors has been the principal reason for aspen decline.

Since 1962, when more effective control of elk numbers was accomplished, most aspen stands have shown no improvement due to continued excessive browsing by elk. However, an upward condition trend has occurred in a few restricted areas, particularly along highways and near developed areas.

Aspen and other palatable browse is secondary to cured grass and grass-like plants in palability and volume consumed by elk on the winter range. However, browse becomes very important in severe winters. Elk may require at least a minimal amount of palatable browse regardless of winter severity. Loss of aspen and other preferred browse could work to the detriment of the elk herd.

In addition to its potential value to elk, aspen has important esthetic, recreational, and scientific value in an area dominated by coniferous forest. Aspen contributes to the park's biotic variety and is important to other major wildlife species such as beaver, moose, and perhaps whitetailed deer which are no longer present in the Park.

A basic purpose of Yellowstone National Park is to preserve the primeval ecosystem. Both aspen and elk were part of that ecosystem and should be retained. Preservation of aspen may not be possible after such a long period of abuse, but it is a goal worth striving for.

Acknowledgment

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